BTL-06

User's Manual
&
User's Guide

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1 GENERAL CHARACTERISTICS

BTL-06 has two independent outputs for simultaneous application of different treatments of one patient or simultaneous therapy of two patients. The equipment is easy to operate. After switching on the equipment automatically checks its internal functions. During therapy It checks the patient circuit's status.

BTL-06 offers more than 1000 modifications of low- and mid-frequency therapeutic currents. The instrument enables to combine and then store different types of currents. It is also possible to create and store rectangular and triangle currents.

The equipment enables to set different current on each of the independent outputs, different time of application as well as intensity. The intensity of current or voltage can be set with the step 0,1 mA (0,1 V), for higher intensities with the step 1 mA (1 V). This enables the therapist to respond promptly and correctly to the patient's feelings.

BTL-06 can work in the constant-current mode or in the constant-voltage mode. This extends the indication possibilities of the equipment, especially in case of use of point-contact electrodes and combining this therapy with the ultrasound.

BTL-06 is manufactured in several modifications. It is possible to interconnect the equipment with the ultrasound equipment BTL-07p and carry out the combined therapy: electrotherapy – ultrasound. To BTL-06 there can be connected the vacuum unit BTL-12.

The equipment BTL-06 must not be used out of accord with the User's Manual.

1.1 Manufactured Equipment Types

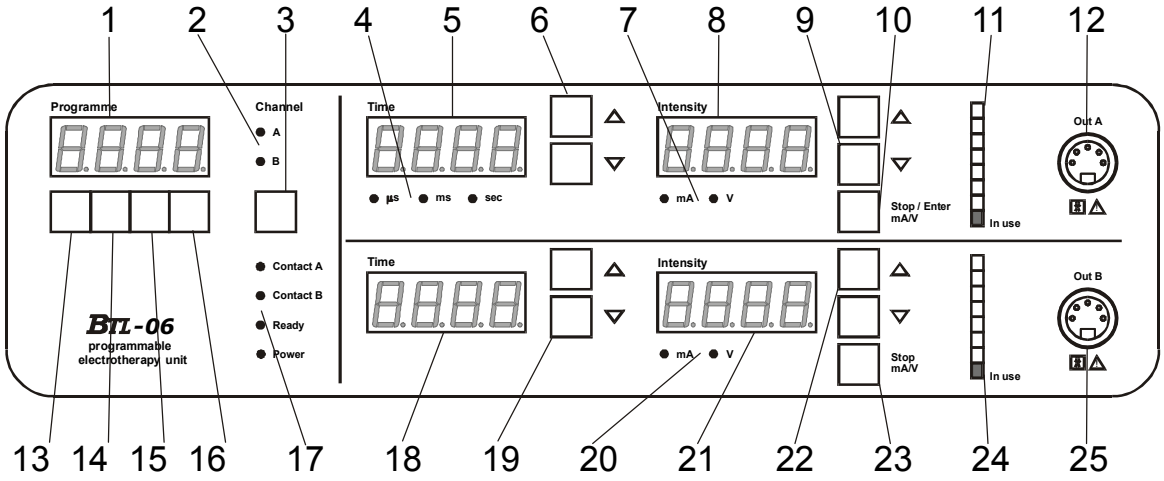
BTL-06 is manufactured in several modifications – types:

Type	Type Name	Type Properties – Number of Outputs – Possible Current Groups
1001	BTL – 06 One Channel	1 applied part current groups: 00 to 04, 98
1002	BASIC PLUS	1 applied part current groups: 00 to 04, 06, 07, 09 to 18, 98
2001	BTL – 06 Two Channel	2 applied parts current groups: 00 to 04, 98
2002	STANDARD	2 applied parts current groups: 00 to 04, 06 to 18, 98
2003	OPTIMAL	2 applied parts current groups: 00 to 04, 06 to 21, 26 to 29, 31 to 33, 60 to 72, 98
2004	TOPLINE	2 applied parts current groups: 00 to 29, 31 to 33, 40 to 57, 60 to 72, 98, 99

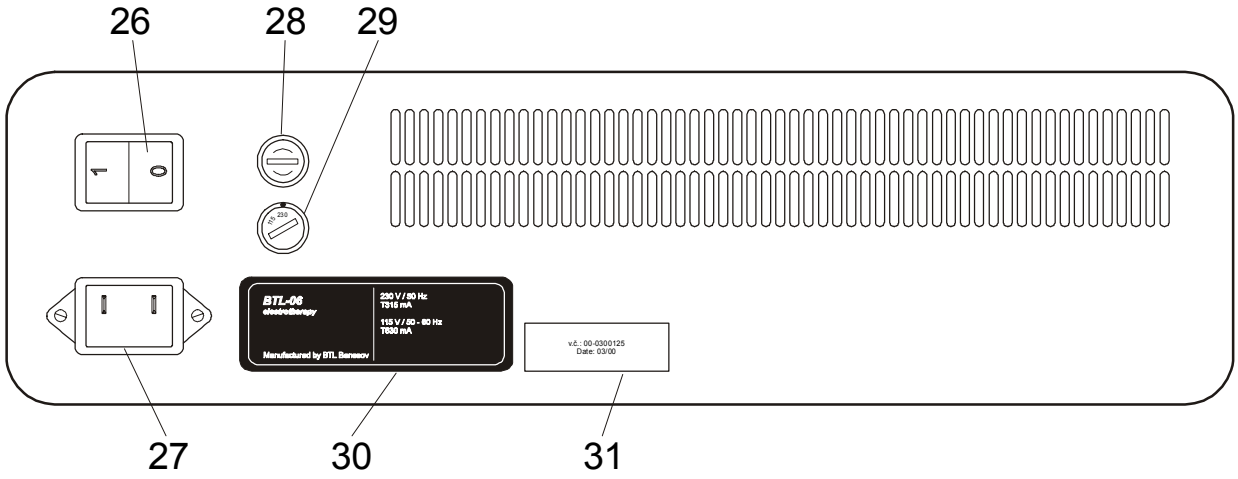
2 USER'S MANUAL

2.1 Description of the Equipment

Front panel of BTL-06



Rear panel of BTL-06



2.1.1 Outward Appearance

The equipment for electrotherapy BTL-06 is installed in a varnished metal box. The front panel contains signalling, displaying and control elements and connectors for electrodes. The rear panel contains the mains cable connector, the main switch, the mains voltage switch (115 V / 230 V) and the fuse.

The manufacture label and the type label are placed on the rear panel of the equipment.

2.1.2 Overview of Controls and Display Elements

1. display **PROGRAMME** displays the code of course of the generated current, the displayed code corresponds to the selected channel – the appurtenant pilot light **CHANNEL (2)** is shining

2. pilot lights **CHANNEL A** and **B** indicate the channel the code of which is set on the **PROGRAMME** display **(1)**

3. button for switching of channels **A** and **B**

4. pilot lights **µs**, **ms** and **sec** indicate the unit of the time value displayed on the **TIME A** display – this is used for measuring of the I/t - curve (group 05) and for programming of user pulses (group 99)

5. display **TIME** of channel **A** displays the set time of therapy in minutes and seconds; during generation there is displayed the time which remains until the end of the application; it has other special functions for current groups 05, 19, 98, 99 and Su
6. buttons ▲/▼ serve for setting the time of application of channel **A**
7. pilot lights **mA** and **V** indicate the output mode of channel **A** (current / voltage)
8. display **INTENSITY** displays the set value of intensity on channel **A**
9. buttons ▲/▼ serve for setting the intensity of the generated current on channel **A**
10. button **STOP/ENTER (mA/V)** serves for termination of generation of current on channel **A** and for switching of voltage/current output mode on channel **A**, and has special functions in current groups 05, 19, 99 and Su
11. the bar graph represents the course generated on channel **A**
12. connector **OUT A** serves for connection of the patient cable of channel **A**
13. button for setting of program groups (thousands)
14. button for setting of program groups (hundreds)
15. button for setting of program numbers (tens)
16. button for setting of program numbers (unities)
17. pilot lights of the equipment status:

CONTACT A	indicates disconnection of the patient circuit or a short-circuit on channel **A**
CONTACT B	indicates disconnection of the patient circuit or a short-circuit on channel **B**
READY	indicates that the equipment is ready for further activity
POWER	indicates that the equipment is on

18. display **TIME** of channel **B** displays the set time of therapy in minutes and seconds; during generation there is displayed the time remaining until the end of application; it has additional special functions for current groups 05, 19, 98, 99 and Su
19. buttons ▲/▼ serve for setting the time of application of channel **B**
20. pilot lights **mA** and **V** indicate the output mode of channel **B** (current / voltage)
21. display **INTENSITY** displays the set value of intensity on channel **B**
22. buttons ▲/▼ set the intensity of the generated current on channel **B**
23. button **STOP (mA/V)** terminates generation of current on channel **B**, switches voltage / current output mode of channel **B** and has special functions in current groups 05, 19, 99 and Su
24. the bar graph represents the course generated on channel **B**
25. connector **OUT B** for connection of the patient cable of channel **B**
26. mains switch for switching the equipment on / off
27. connector for the mains cable of the type EURO PC
28. replaceable fuse
29. mains voltage switch (115V / 230V)
30. type label
31. manufacture label

2.2 Putting the Equipment into Operation

Before putting the equipment into operation please read carefully this Manual, especially Section **2.9 Safety Precautions.**

Put the equipment on a solid flat board dimensioned for the equipment's weight, in sufficient distance from any heat source and electromagnetic radiation and out of reach of sunbeams. The equipment is cooled by spontaneous air circulation. The cooling vents on the rear panel and on the bottom cover of the equipment must stay uncovered (the equipment must stand on legs, at least 5 cm from any wall). Do not put any inflammable things, heat sources and pots containing liquids on the equipment.

Before first switch-on of the equipment check if the voltage switch on the rear panel is in the position corresponding to the local mains voltage. In case of uncertainty contact the BTL serviceman. The process of switching is described in Section 2.8 Maintenance and Transport.

Plug the equipment directly in the mains socket, do not use any extension cable or adaptor.

Switch over the main switch **(26)** on the rear panel to the position "**0**". Plug the mains cable in the supply connector on the rear panel of the equipment; the other end plug in the mains socket. Then switch the equipment on by the main switch **(26)** – to position "**1**".

The **POWER** pilot light **(17)** on the front panel lights up and the **PROGRAMME** display **(1)** displays the equipment type for approximately 2 seconds (it corresponds to the types stated in Section **1.1 Manufactured Equipment Types**.)
Displays **TIME A (5), TIME B (18), INTESITY A (8)** and **INTENSITY B (21)** then show zero values and the **PROGRAMME** display **(1)** displays the program number "0001". This display is switched over to channel A (the **CHANNEL A** pilot light **(2)** is shining). Both channels **A** and **B** are set in the current mode (pilot lights **mA (7)** and **mA (20)** are shining). The automatic self-test of the equipment is running until the **READY** pilot light **(17)** lights up.

For one-patient units (types 1001 and 1002) the generator of channel B in the equipment is not installed. The displays of channel B – **TIME B (18)** and **INTENSITY B (21)** display four dashes **----** and the buttons of channel B are functionless. Channel A works as described in this document.

If the equipment is protected by an access code the **POWER** pilot light **(17)** on the front panel lights up and the **PROGRAMME** display **(1)** displays the equipment type for 2 seconds. Then the **TIME A** display **(5)** shows the message *CodE* and the **INTENSITY A** display **(8)** displays code "*0000*". Now enter the access code to unlock the equipment. Set the access code on the **INTENSITY A** display **(8)** by buttons **TIME A ▲/▼ (6)** (first and second digit of the code) and **INTENSITY A ▲/▼ (9)** (third and fourth digit of the code). Confirm the correctly set access code by pressing the **STOP/ENTER** button **(10)**.
If the access code of the equipment is "*0000*" (preset from the manufacturing) the equipment is "unlocked" and enables handling immediately after evaluation of tests and lighting up of the **READY** pilot light **(17)**. Setting of the access code is described in Section **2.5.1 Change of the Access Code (user function Su00)**. Also if you forget the access code, follow the instructions of the above-mentioned Section.

Note:
After switching on, the equipment tests its internal circuits and in case of finding out an error it displays the message *Err* on the **TIME** display of the appurtenant channel and the error number on the **INTENSITY** display. See Section **2.6 List of Error Messages.**

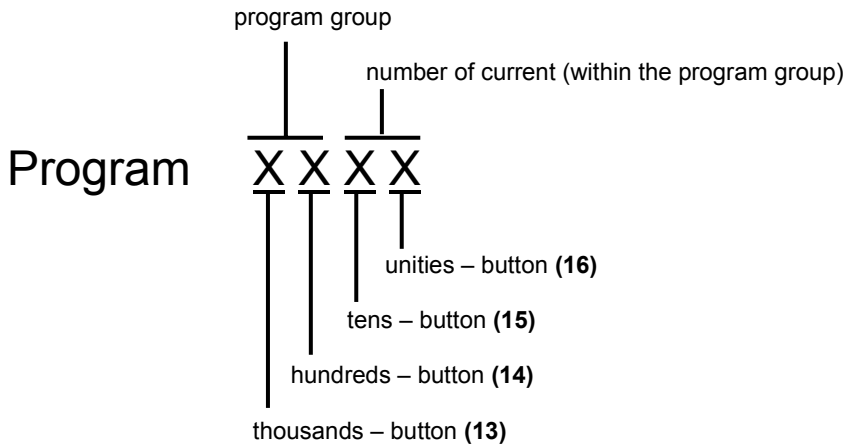
2.3 Setting of Therapy Parameters

2.3.1 Selection of Channel

Initially use button **CHANNEL (3)** to select the channel which the patient shall be connected to during the therapy. Channel **A** is preset after switching on – pilot light **CHANNEL A (2)** is shining.
Display **PROGRAMME (1)** always displays the code of the course on the selected channel. The code of the other channel is stored in the equipment's memory.
Simultaneous shining of both pilot lights **CHANNEL A** and **B (2)** indicates that the program uses both channels. (Current groups 05, 08, 20 to 26.)

2.3.2 Program Settings

By the buttons **(13)**, **(14)**, **(15)**, **(16)** set the required current group and the number of the course, which specifies the current parameters in this group, on the **PROGRAMME** display **(1)**. The program number consists of four digits. The first two digits make up a two-digit number that identifies the program **group**. The third and fourth digit make up a two-digit number that specifies further parameters of current in the given program group – see **7 Overview of All Programs**.



Pressing of one of the buttons **(13)**, **(14)**, **(15)**, **(16)** increases the value of the corresponding digit on the **PROGRAMME** display **(1)**. If the next higher number is inaccessible, the next higher accessible number is displayed. All digits in the program number on the **PROGRAMME** display **(1)** can be set only within the range given by the technical parameters and the type of the purchased equipment.
During generation, the program number cannot be changed. Only for groups 05, 22 and 23 the generated current can be modified by setting of unities – the button **(16)**.
For the list of all programs see Section **7 Overview of All Programs.**

2.3.3 Setting of Time

On the **TIME A** display **(5)** set the required time of application of the selected course (minutes and seconds). Pressing of the button ▲ **(6)** increases and of the button ▼ **(6)** decreases the time of therapy on channel **A**. The step for setting of time is 30 seconds; when holding the button ▲ **(6)** or ▼ **(6)** the time changes with the 1-minute step.
Owing to the fact that increments and decrements of the set time run in the 60-minute cycle, you can use button ▼ **(6)** instead of ▲ **(6)** for setting of longer time. In such case the value *60:00* comes after *00:00*.
For setting of duration of application on the **TIME B** display **(18)** use the buttons ▲/▼ **(19)**.
The countdown of the time interval starts after the start of generation (setting of nonzero value of intensity). During the whole time of generation, display **TIME A (5)** or **TIME B (18)** displays the time remaining until the end of the application. After expiration of the set time, the generation is automatically terminated. The attendant is notified about the end by a sound signal which you can set by yourself. Selection of the sound signal is described in Section **2.5.2 Setting of the Sound Mode (user function Su01)** and **2.5.3 Setting of the Sound Type of the End of Therapy (user function Su03)**.
The time of generation can be also corrected during therapy as needed.

2.3.4 Current / Voltage Mode

Both channels, **A** and **B**, can work in the current mode or in the voltage mode. After switch-on of the equipment there is preset the current mode on both channels (pilot lights **mA (7)** for channel **A** and **mA (20)** for channel **B** are shining).
To switch between the current / voltage modes press the **STOP A/ENTER** button **(10)** for channel **A** or the **STOP B (23)** button for channel **B**. Switching of the channel to the current / voltage mode is accompanied by a sound signal.
The current / voltage mode can be switched over only if the intensity on the corresponding channel is set to zero.

current mode	- the corresponding **mA** pilot light is shining
voltage mode	- the corresponding **V** pilot light is shining

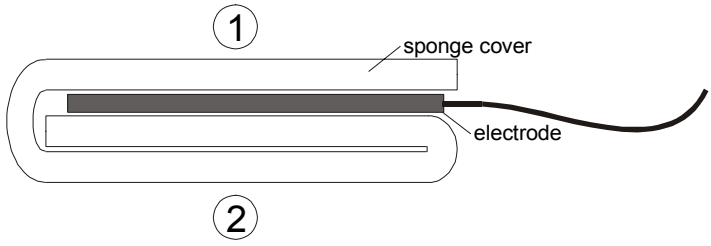
Generally, the current mode of the equipment is more suitable for application by plate or suction electrodes (in connection with BTL-12). If you use electrotherapy combined with ultrasound (BTL-07p) or apply it by a point-contact electrode, choose the voltage mode rather. The voltage mode also can be more suitable when small plate electrodes are used and also for motor stimulation of muscles. For more details see Section **4 User's Guide**.

2.3.5 Connection of Electrodes

Plug the patient cable in connector **OUT A (12)** or **OUT B (25)** on the equipment and put the plate electrodes with the sponge covers on the coloured connectors. The plate electrode must not come in direct contact with the patient's skin!

red plug	- anode (positive polarity)
green plug	- cathode (negative polarity)

The electrode sponge covers and the place of application shall be well moistened, to prevent the patient from burning. The moistening can be done with ordinary water or, in case of iontophoresis, by the required therapeutic solution.
At generation of low-power currents (TENS) apply side 1 of the electrode in the sponge cover to the patient's body. One ply of the sponge cover will be between the electrode and the patient's skin. For high-power currents (recommended for all currents except TENS) apply side 2 of the electrode in the sponge cover to the patient's body.
Rinse the electrode sponge covers thoroughly before first use! From the manufacturing they are impregnated with special substance which prevents them from hardening.
After washing and drying the electrode covers harden. It is not a failure – after moistening they will get soft again.



If you want to perform the therapy by a point-contact electrode connect it in place of one of the plate electrodes on the patient cable. Take off the rubber ring on the point-contact electrode's tip, moisten a piece of mull and fasten it to the point-contact electrode's tip with the rubber ring. Attach the plate electrode to the patient's body and scan the selected area with the point-contact electrode. For application of therapy by the point-contact electrode it is suitable to choose the voltage mode; details are described in Section **2.3.4 Current / Voltage Mode**.

2.3.6 Setting of Intensity – Start of Therapy

To start the prepared therapy set nonzero intensity on the **INTENSITY A** display **(8)**. Button ▲ **(9)** serves for increasing of intensity on channel **A**, button▼ **(9)** for decreasing or possibly setting of negative value of the intensity. The step for setting of intensity is 0,1 mA or 0,1 V; when holding button ▲ **(9)** or ▼ **(9)** the intensity changes with the step 1 mA or 1 V. From the intensity value 20 mA or 20 V up the step is always 1 mA or 1 V, respectively.
Each change from the zero value (start of therapy) or to the zero value (end of therapy) is accompanied by a sound signal.
Similarly, for setting the values of voltage/current on the **INTENSITY B** display **(21)** for channel **B** use buttons ▲/▼ **(22)**.

2.3.6.1 Reversal of Polarity of Electrodes

The polarity of output electrodes can be easily reversed – by setting the "negative" intensity. When generation is running (a nonzero value is on the **INTENSITY A** display **(8)**) and you want to reverse the polarity of the output electrodes, you have to interrupt the running therapy – see paragraph **2.4.2 Interruption of Therapy**. When the intensity value is zero, press button ▼ **(9).** The minus sign appears in front of the set intensity value on the **INTENSITY A** display **(8)**. At the same time the therapy is run. Then set the required intensity – similarly as in the paragraph**2.3.6 Setting of Intensity – Start of Therapy**. However, the sense of the buttons ▲ / ▼ **(9)** is reverse: button ▼ **(9)** serves for increasing and ▲ **(9)** for decreasing of the intensity.
A similar procedure applies for channel B, yet you have to use buttons ▲/▼ **(22)**.
For symmetric courses with zero DC component there is no point in differentiation between positive and negative values of intensity, therefore you can set only the positive values and the polarity of courses cannot be reversed. Currents for which both polarities of the output signal can be set, and the polarity can be reversed, are marked **(+/-)** in Section **7 Overview of All Programs**.

2.3.7 Functions of the Bar Graph

If there is voltage on the output of channel **OUT A** or **OUT B** the lower yellow pilot light lights up on the bar graph **(11)** or **(24)**, respectively.
In the voltage mode (**V** pilot light **(7)** or **(20)** is shining) the bar graph displays the aliquot part of the maximum value of intensity that can be set.
In the current mode (**mA** pilot light **(7)** or **(20)** is shining) the bar graph symbolically displays the course of the applied current.

2.3.8 Check of the Patient Circuit at Setting of Intensity

Current mode – **mA** pilot light **(7)** or **(20)** is shining:
At setting of intensity the equipment checks the patient circuit's resistance. If this resistance is too high, the required value of current intensity cannot be set (the equipment cuts it down permanently). The high resistance of the patient circuit may be caused by wrong application of electrodes, insufficient moistening of electrode sponge covers or faulty electrodes or cable.
This function can be disabled – see Section **2.5.8 Setting of the Patient Circuit Check (user function Su10)**.

Voltage mode – **V** pilot light **(7)** or **(20)** is shining:
At setting of intensity the equipment checks the patient circuit's resistance. If this resistance is too low and the maximum allowed value of current could be exceeded – the whole bar graph **(11)** or **(24)** is shining – the required value of voltage intensity cannot be set (the equipment cuts it permanently down to the value specified in the standard IEC 60 601-2-10).

2.3.9 Check of the Patient Circuit during Therapy

This function applies only in the current mode – **mA** pilot light **(7)** or **(20)** is shining.
During therapy the patient's connection to the equipment is checked. If the patient circuit is disconnected, the equipment cuts down the current intensity to the secure value 0,5 mA. Voltage on the output in this status is maximum 24 V, i.e. secure voltage. The value on display **INTENSITY A (8) (INTENSITY B (21))** starts twinkling and the time countdown on display **TIME A (5) (TIME B (18))** stops. The equipment informs the attendant about this status by a sound signal. Check the patient circuit (application of electrodes, their moistening, etc.). After re-establishment of the contact between the electrodes and the patient's body the equipment will continue in generation.
This function can be disabled – see Section **2.5.8 Setting of the Patient Circuit Check (user function Su10)**.

2.4 Additional Information for Application of Therapy

2.4.1 Start of Therapy

Select channel which you want to generate from and set the required values on displays **PROGRAMME (1)** and **TIME**. After setting a nonzero value on the **INTENSITY** display of the pertinent channel there starts generation of the course you set. On the **TIME** display the set time starts to count down. The bar graph represents the generated course. Start is announced by a sound signal.

2.4.2 Interruption of Therapy

Generation of current can be stopped anytime by pressing button **STOP A/ENTER (10)** or **STOP B (23)** of the pertinent channel. The intensity drops to zero, time countdown stops and the set selected course remains on. To continue in generation set the intensity again. Interruption is announced by a sound signal.
Do not interrupt the application by removing the electrodes from the patient's body during generation!
Do not interrupt the application by shutting off the mains switch!

2.4.3 End of Therapy

The therapy ends as soon as the displayed therapy time value gets to zero. The end is announced by a sound signal. You can also stop the therapy by its interruption – i.e. by pressing button **STOP A/ENTER (10)** or **STOP B (23)** of the pertinent channel.
Do not interrupt the application by removing the electrodes from the patient's body during generation!
Do not interrupt the application by shutting off the mains switch!

2.4.4 Independent Generation from Both Channels

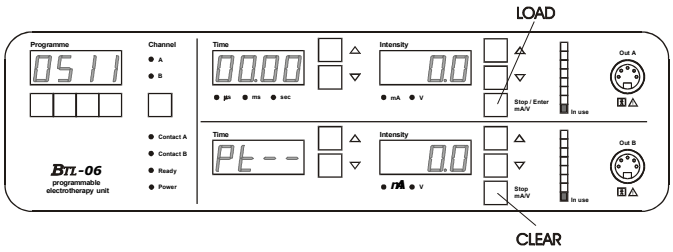
If one of the channels (e.g. **A**) is in operation, you can generate from the other channel (**B**) at the same time. This second channel can be connected to another patient, and different program and therapy time can be set on it. The **PROGRAMME** display **(1)** displays the code of course on the channel of which the **CHANNEL** pilot light **(2)** is shining. The **CHANNEL** button **(3)** switches the data on the **PROGRAMME** display **(1)**. This is not true for the programmes which use both channels simultaneously (groups 05, 08, 20 to 26).

2.4.5 Measuring of I/t-curve (group 05)

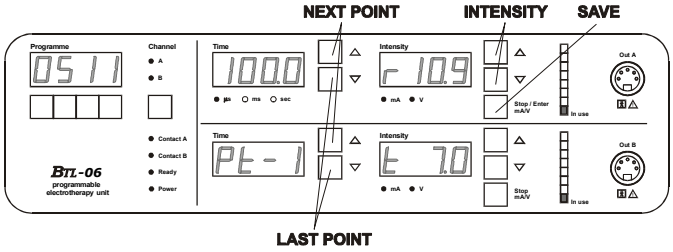
Measuring of I/t curve can be set only on channel **A** and only if there is no course generated from channel **B**. After setting of this group both pilot lights **CHANNEL A** and **B (2)** light up. If you generate on channel **B**, group 05 cannot be set on channel **A**. In such case displays **TIME A (5)** and **INTENSITY A (8)** display "**----**".
Displays of channel **B** serve for displaying of values of the already measured I/t curve either on the other (e.g. healthy) muscle (groups 052x and 054x) or with pulses of different course (groups 051x and 053x). The length of the stimulation impulse is shown on the **TIME A** display **(5)**, the unit of the impulse is indicated by the shining pilot light **µs, ms** or **s (4)**. The equipment beeps at each generated impulse. The sound signal's length approximately corresponds to the length of the stimulation impulse. After measuring of the I/t curve the equipment specifies the value of chronaxie and rheobasis and performs the required calculations of the accommodation coefficient (groups 051x and 053x) or determination of the most suitable stimulation (groups 052x and 054x).
The measured I/t curve can have up to 21 points but it is not necessary to measure all of the stated points. The points with the zero intensity are not to be included in calculations of chronaxie and rheobasis and in evaluation.
The accommodation coefficient can be measured independently without gauging of the whole I/t curve – measuring of values for pulses of the length 1 sec. is sufficient.
After measuring, all I/t curves remain stored in the equipment's memory until you overwrite them by new data or delete them.
For more details on measuring and evaluation of I/t curve see Section **4 User's Guide**.

2.4.5.1 Description of the Equipment's Function at Measuring of I/t-curve

If you select any group for measuring of I/t curve (05xx) the equipment's panel displays:



By pressing the **STOP A/ENTER** button **(10)** which at this moment represents the **LOAD** function you will load from the memory the last measured curves on positions 0511 and 0512 on the channel A and channel B displays respectively (in this depicted case).
By pressing the **STOP B** button **(23)** which at this moment represents the **CLEAR** function you will clear both these curves (0511 and 0512) and get ready for next measuring. After pressing the button, the **INTENSITY A** display **(8)** for a moment displays confirmation of the action (*LOAd / CLr*). The pressing is accompanied by an acoustic signal. Then the equipment switches to the I/t-curve measuring mode and displays:



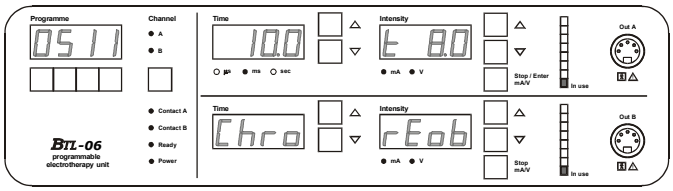
- on the **TIME A** display **(5)**: length of the generated pulse; pilot lights **µs**, **ms** and **s (4)** provide information about time units,
- on the **TIME B** display **(18)**: symbolic identification of the point on the I/t curve being measured (from Pt 1 to Pt 21),
- on the **INTENSITY A** display **(8)**: intensity of pulse for the given point and I/t curve (Pt 1 and 0511 in this case),
- on the **INTENSITY B** display **(21)**: intensity for the given point and the other I/t curve (0512 in this case).

Displays **INTENSITY (8)** and **(21)** show also symbolic indications of pulse shapes – **"t"** (triangle) and **"r"** (rectangle).

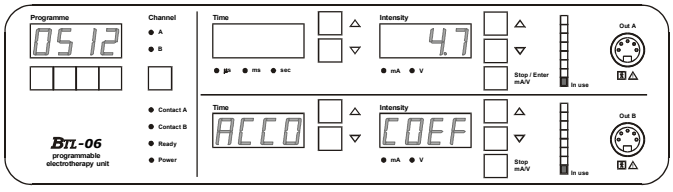
The buttons' functions are the following:

- buttons for setting of programs **(13)** to **(16)** keep their function; by these buttons you will leave the I/t-curve measuring,
- buttons **TIME ▲ (6)** or **(19)**, which now have the function **NEXT POINT**, provide passage to the next measured point,
- buttons **TIME ▼ (6)** or **(19)**, which now have the function **PREVIOUS POINT**, provide passage to the previous measured point (since selection of the point runs in a cycle, point Pt 1 follows point Pt 21 and evaluation, and vice versa),
- the **INTENSITY A ▲** button **(9)** starts generation and increases the pulse intensity from the value 0,1 mA,
- the **INTENSITY A ▼** button **(9)** decreases the pulse intensity,
- the **STOP A/ENTER** button **(10)**, which now represents also the function **SAVE**, stops generation of pulses, saves the set intensity value into the equipment's memory and provides passage to measuring of the next point. If you do not want to save the measured value, you can press button **TIME ▲ (6)** or **(19)** to interrupt generation and pass to the next point.
- the **PROGRAMME – UNITIES** button **(16)** serves for switching between measuring of the first and the second I/t curve. By pressing this button you will save the set value of intensity, interrupt generation and pass to measuring of the other I/t curve.

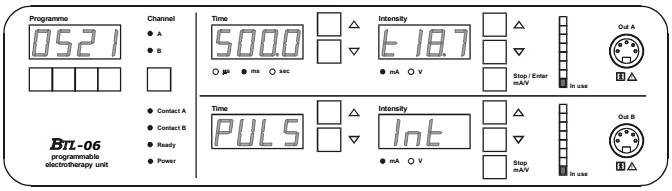
It is not necessary to measure the whole I/t curve. Choose points which – by your experience – are most important for your measurement. However, for calculation of values of chronaxie and rheobasis it is recommended that you measure as many as possible points of the I/t curve. It is the only way to get reliable results. For specification of the accommodation coefficient it is sufficient to measure only the intensity values on point Pt 21 by 1-second long pulses. Calculation of chronaxie and rheobasis follows immediately after Pt 21 – it will be performed by pressing button **TIME ▲ (6)** or **(19)**:



The **TIME A** display **(5)** displays the value of chronaxie, the unit of the pulse length value is indicated by the pilot light **µs**, **ms** or **s (4)**. The **INTENSITY A** display **(8)** shows the value of rheobasis and indicates the pulse shape – **"t"** (triangle) and **"r"** (rectangle). By repeated pressing of button **TIME ▲ (6)** or **(19)** you get to calculation of the accommodation coefficient (it is shown on the **INTENSITY A** display **(8)**) for curves 051x and 053x,



or to calculation of the most suitable stimulation of the damaged muscle for curves 052x and 054x:



The **TIME A** display **(5)** shows the length of the recommended stimulation pulse, the unit of the pulse length value is indicated by the pilot light **µs**, **ms** or **s (4)**. The **INTENSITY A** display **(8)** shows the required value of intensity. For the consequent stimulation we recommend the triangular pulse.

If a calculation cannot run (lack of measured points, the curves do not cross etc.) displays show "**----**" instead of the results.

Each measurement of the I/t curve can be divided into several points:

- determination of the motoric point of the muscle,
- determination of the muscular lesion (by measuring of either the accommodation coefficient or the whole I/t curve by rectangular and triangular pulses – groups 051x or 053x),
- determination of the most suitable area of stimulation (comparison of the I/t curve of the healthy and the denervated muscle measured by triangular pulses – groups 052x or 054x). Pulse group 06xx is dedicated for the consequential stimulation.

At measuring of the I/t curve be extremely careful! The equipment does not measure impedance of the patient even if the patient-connection check function is activated. Pulses for measuring are generated even if the patient is disconnected.
Owing to the fact that you use a point-contact electrode for stimulation, the square density of current on the skin could exceed the maximum allowed value 2 mA/cm^2. Be careful, there could occur lesion of the skin surface.

2.4.5.2 Determination of the Motoric Point

Before any measuring of the I/t curve or the accommodation coefficient you have to find the motoric point of the muscle. It is the point in which you will then perform measuring and stimulation. In this point the muscle should be most sensitive to stimulation and the muscle's response should be strongest.
Process of determination of the motoric point: select a group of I/t curves which you want to measure (051x to 054x), set pulses of the length 50 msec to 100 msec (Pt 14 to Pt 16), set intensity approx. 10 mA and by shifting of the point-contact electrode find the strongest response of the muscle.

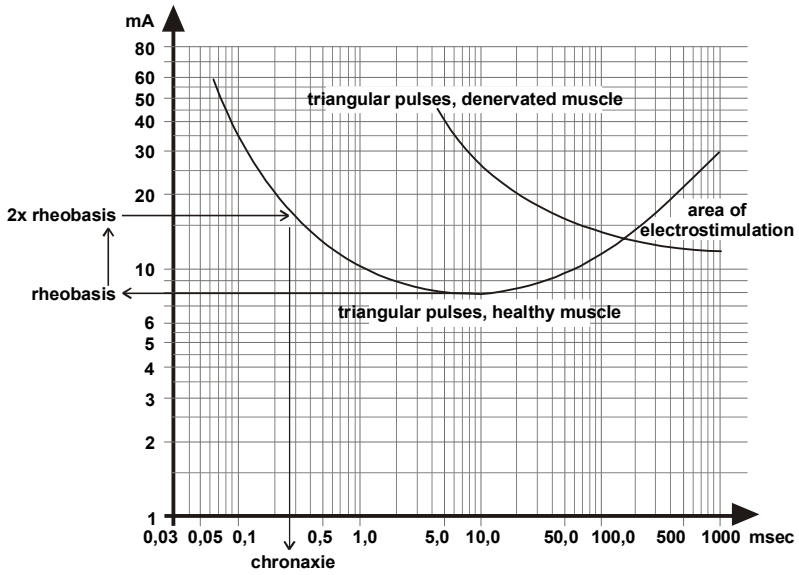
2.4.5.3 Measuring of the Accommodation Coefficient

The accommodation coefficient is the ratio of intensity of the triangular 1-second-long pulse to that of the rectangular 1-second-long pulse. This ratio for a healthy muscle is 3 - 6, in case of the muscle's excitability dysfunction this value is lower.
For measuring set the program "0511" or "0531" on the **PROGRAMME** display **(1)**. To load the last measured I/t curve from the equipment's memory press the **STOP A/ENTER** button **(10)**, to clear the last measured data press the **STOP B** button **(23)**.
The accommodation coefficient can be measured independently without measuring of the whole I/t curve – measuring of values for 1-second-long pulses is sufficient. On the **TIME B** display **(18)** set the entry *Pt 21* by buttons **▲/▼ (6)** or **(19)**. The **TIME A** display **(5)** then shows the value *1.0* and the **sec** pilot light **(4)** is shining. The equipment is ready for measuring of the rectangular 1-second-long pulse. Set the intensity and after determination of the excitability threshold you can save this value by pressing the **STOP A/ENTER** button **(10)**. Press once the button **(16)** and on the **PROGRAMME** display **(1)** set the program for measuring of the triangular 1-second-long pulse. Again, set the intensity and after determination of the excitability threshold save this value by pressing the **STOP/ENTER** button **(10)**.
On the channel **B** displays **(18)** and **(21)** set the entry *ACCO COEF* by buttons **▲/▼ (6)** or **(19)**; the **INTENSITY A** display **(8)** will write the calculated value of the accommodation coefficient.

2.4.5.4 Measuring of Chronaxie and Rheobasis

After measuring of the I/t curve (at least 3 - 4 values) you can pass to calculation of chronaxie and rheobasis by buttons **▲/▼ (6)** or **(19)**. Chronaxie is displayed on the **TIME A** display **(5)**, rheobasis on the **INTENSITY A** display **(8)**. According to the definition:

- rheobasis is the lowest intensity of current (mA) necessary to evoke the muscle contraction;
- chronaxie is the length of the current pulse which evokes the muscle contraction; intensity of this pulse is 2x higher than rheobasis.



2.4.5.5 Determination of the Most Suitable Stimulation

Measure both curves in group 052x or 054x. One of them on a healthy muscle, the other on a denervated one. The ends of the I/t curves, i.e. points from approx. 50 msec on (Pt 14 and higher), are the most important for this calculation. Here you should measure as many points as possible; for correct calculation you must measure the same points on both curves. After measuring of curves by buttons **▲/▼ (6)** or **(19)** proceed to calculation of the most suitable stimulation. Displays of channel **B** display *PULS* and *Int*, the **TIME A** display **(5)** shows the value of the recommended pulse length and the **INTENSITY A** display **(8)** displays its intensity. For the consequential stimulation use the triangular pulses from the group **06xx**.

2.4.5.6 Deletion and Saving of the Measured I/t-curve

The measured points of the I/t-curve are saved in the equipment's memory immediately after the measuring – pressing the **STOP A/ENTER** button **(10)**. That is, as soon as you complete measuring of the I/t-curve it is automatically saved in the equipment's memory.
The curve can be deleted from the equipment's memory only before a new I/t-curve measuring. For detailed description see the beginning of the paragraph **2.4.5.1 Description of the Equipment's Function at Measuring of I/t-curve**.

2.4.6 Four-pole Interference (groups 08, 26)

Generation of the four-pole interference, as well as the other four-pole courses, can be set only on channel **A**, and only if there is no course generated from channel **B** at the same time. After setting of this group both pilot lights **CHANNEL A** and **B (2)** light up and the time value disappears from the **TIME B** display **(18)**. If you are generating on channel **B**, group 08 or 26 on channel A cannot be set. In such case displays **TIME A (5)** and **INTENSITY A (8)** show "**----**".
Initially switch to channel **A**, set the required program number on the **PROGRAMME** display **(1)** and time of application on the **TIME A** display **(5)**. To run the program press buttons **▲ (9)** of intensity of channel **A**. For four-pole courses you control the value of intensity of both channels simultaneously – the set value is displayed on both displays **INTENSITY (8)** and **(21)**.
By buttons **▲/▼ (22)** of intensity of channel **B** you can "weigh out" the intensity values after the start of the therapy, i.e. set a different value of intensity for each channel and thus for example compensate the asymmetric positions of electrodes. Then set the intensity on each channel separately.
To interrupt / terminate generation in both channels at the same time press button **STOP A/ENTER (10)** or **STOP B (23)**.

Most often the electrodes are attached crosswise; the interference causes low-frequency current surges in the tissue. In related literature this is called "classic interference". For more details see Section **4 User's Guide**.

2.4.7 Isoplanar Interference Field (groups 20, 21)

Control of this group is the same as for groups **2.4.6 Four-pole Interference (groups 08, 26)**.
Courses of current in these groups are very similar to the classic interference but – thanks to the amplitude modulation of both channels – the therapeutic area in the tissue is wider. For more details see Section **4 User's Guide.**

If the display shows the error message *Err 605* when you are trying to start the application, it indicates non-functional internal synchronization of channel B and channel A and the equipment cannot generate this type of currents. In such a case please contact the customer service department of the company stated at the end of this document. The other programmes can be used without limits.

2.4.8 Dipole Vector Field (groups 22, 23, 24 and 25)

Control of this group is also the same as for groups **2.4.6 Four-pole Interference (groups 08, 26)**.
Courses of current in these groups are very different from the classic interference. Both channels have the same frequency but different amplitude and phase. In the tissue the interference creates a dipole (that is, the field acts only in one direction). You can rotate this dipole by change of modulation of the amplitude and the phase and thus determine the most suitable direction of the dipole's effect.
You can rotate the dipole manually by pressing the button **(16)**, even during generation, and let it act in the set direction during the whole time of application (groups 22 and 23).
To set the automatic rotation of the dipole, i.e. its spontaneous rotation and action within the whole area between the electrodes, choose group 24 or 25.
For more details see Section **4 User's Guide**.

If the display shows the error message *Err 605* when you are trying to start the application, it indicates non-functional internal synchronization of channel B and channel A and the equipment cannot generate this type of currents. In such a case please contact the customer service department of the company stated at the end of this document. The other programmes can be used without limits.

2.4.9 Programmable Sequences (Cocktails) (group 19)

In group 19 you can sentence the individual courses of current one after another in so-called sequences – "cocktails". One sequence consists of up to 10 currents (programmes). Maximum total time of the sequence is 60 minutes, the shortest possible segment of a sequence is 30 seconds. You can select polarity (+/-) of the inserted currents. For the passage of current in the sequence to the next included current you can specify if generation shall stop and wait for new setting of intensity or if it shall continue with the intensity that was set at the beginning of the generation (so-called continuity of sequences – from the manufacturing it is set *On* – see Section **2.5.9 Setting of the Continuity of Sequences (user function Su11)**). The sequential sorting of diadynamic currents is the most frequent in practice, however, this model of the equipment enables to sentence also other courses.
If the "sequence continuity" is on – i.e. after passage from current to the next current – the generation continues with the intensity which was set at the beginning; you must be very careful at creation of sequences. Realize that the patient feels each current in a different way and while for example for TENSes the patient normally withstands the intensity about 100 mA, for diadynamics the maximum tolerable intensity is usually 2 – 3 times lower. Therefore it is always suitable to compose the sequences of those currents which the patient feels in a similar way. In addition you should not combine DC courses with the AC ones. For example, you should create sequences consisting only of:

- diadynamic currents (groups 01, 31, 32 and 33)
- pulses of one polarity with the DC component and the same length (e.g. group 02)
- pulses with the zero DC component (e.g. groups 03 and 04)
- medium-frequency bipolar currents (e.g. groups 07, 28, 29)
- two-pole interference (e.g. groups 09, 27)
- TENSes of the same base length

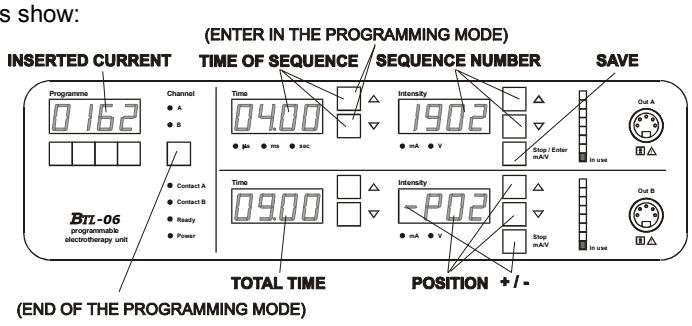
From the manufacturing the diadynamic sequences No. 1900, 1901, 1902, 1903 and 1904 are predefined in the equipment's memory. Their structure is in Section **7 Overview of All Programs**, group 19.
The programmed sequences can be run on both channels of the equipment at the same time.

2.4.9.1 Running of a Programmable Sequence

The process of running of a programmable sequence is the same as for the other courses – see Section **2.3 Setting of Therapy Parameters**. Set number of the program sequence you want to run. Time is already programmed; to run generation press the **INTENSITY** button.

2.4.9.2 Creation of a Programmable Sequence

When you are going to create or edit a programmable sequence you must not be generating anything on the equipment. Switch the equipment to channel **A** – pilot light **CHANNEL A (2)** is shining; on display **PROGRAMME (1)** set a group **19xx** (e.g. current 1900) and press buttons **TIME A ▲ ▼ (6)** simultaneously. The equipment then plays the theme and the displays show:



Functions of buttons and displays in this mode will be the following:

- number of the sequence you want to program is on the **INTENSITY A** display **(8)**; it is set by the buttons **(9)**,

- position of current in the sequence is on the **INTENSITY B** display **(21)**; it is set by the buttons **(22)**,
- by the buttons **(13)**, **(14)**, **(15)** and **(16)** set the number of current you want to insert in the sequence on the **PROGRAMME** display **(1)**
- by the buttons **(6)** set the time of duration of the inserted current on the **TIME A** display **(5)**,
- by the **STOP B (23)** button set the polarity of the inserted current (it cannot be set on position P01),
- by the **STOP A/ENTER** button **(10)** insert the set current in the sequence.

After insertion of the current in the sequence (pressing of the **STOP A/ENTER** button **(10)**) the calculation of the total time of the sequence will run; the time will be shown on the **TIME B** display **(18)**. If the total time of the sequence exceeds 60 minutes, display **TIME B (18)** shows the message *Err*. Such sequence will be misrepresented at start – it must be corrected by insertion of shorter times.

To stop programming press the **CHANNEL** button **(3)**.

2.4.10 Programmable Pulses (group 99)

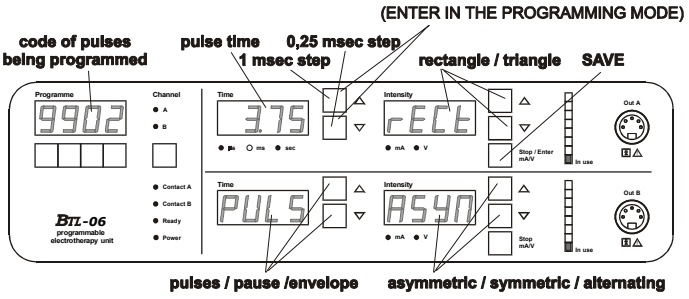
In this group you can program your own current – course. You can select the pulse shape (triangular, rectangular, unidirectional pulses, symmetric and alternating), set the pulse length from 1 msec to 64 msec, length of the pause from 1 msec to 5 sec, form the pulse envelope – create the current surges from the pulses.
From the manufacturing there are predefined the pulses 9900, 9901, 9902, 9903 and 9904 in the equipment's memory. Their description is in Section **7 Overview of All Programs**, group 99.
The programmed pulses can be run on both channels of the equipment at the same time.

2.4.10.1 Running of Programmable Pulses

The process of running of programmable pulses is the same as for the other courses – see Section **2.3 Setting of Therapy Parameters**. Set the code of the programmed pulses, set the time of therapy and start generation by pressing the **INTENSITY** button.

2.4.10.2 Creation of User Pulses

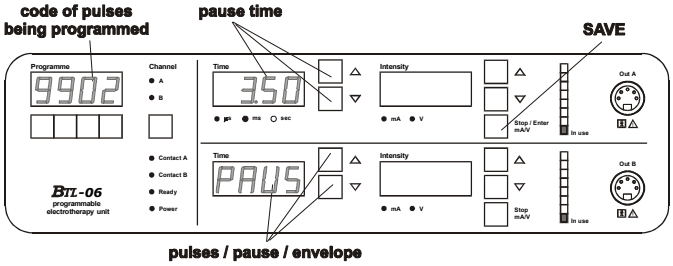
When you are going to create or edit programmable pulses you must not be generating anything on the equipment. Switch the equipment to channel **A** – pilot light **CHANNEL A (2)** is shining; on display **PROGRAMME (1)** set a group **99xx** (e.g. current 9900) and press buttons **TIME A ▲ ▼ (6)** simultaneously. The equipment then plays the theme and the displays show:



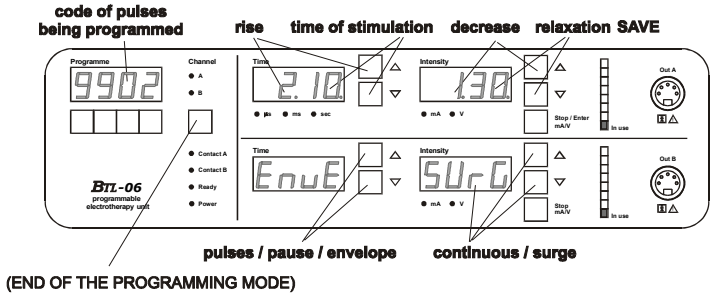
Functions of individual displays and buttons can be seen on the figure:

- code of the pulses you want to program is on the **PROGRAMME** display **(1)**; it is set by the buttons **(15)** and **(16)**,
- time of pulse (msec) is on the **TIME A** display **(5)**; it is set by the buttons **(6)** – the step of the upper button is 1 msec, for the lower one it is 0,25 msec,
- the **INTENSITY A** display **(8)** shows the pulse shape; it is set by the buttons **(9),**
- the **INTENSITY B** display **(8)** shows the pulse course; it is set by the buttons **(22),**
- to save, press the **STOP A/ENTER** button **(10)**.

To setting of the pause length you will proceed immediately after saving of the pulse parameters or by pressing the button **(19)**. The displays will show:



The time of the pause shall be set by the buttons **(6)** on display **TIME A (5)**. After saving (press **STOP A/ENTER (10)**) you will proceed to the settings of the envelope; you can get there also by pressing the buttons **(19)**:



In this case the function of buttons and displays is the following:

- on the **INTENSITY B** display **(21)** set by the buttons **(22)** whether you require the continuous course of current or so-called current surges (*Cont / SUrG*),
- displays **TIME A (5)** and **INTENSITY A (8)** show the parameters of the current surge. The individual values are separated by the dot, are expressed in seconds and the controls are as follows:
- wave rise is controlled by the **TIME A ▲** button **(6)**
- time of stimulation is controlled by the **TIME A ▼** button **(6)**
- wave decrease is controlled by the **INTENSITY A ▲** button **(9)**
- time of relaxation is controlled by the **INTENSITY A ▼** button **(9)**.

To save the set values press the **STOP A/ENTER** button **(10)**. To stop programming press the **CHANNEL** button **(3)**.

2.4.11 Test of Electrodes and Cables (group 98)

This group contains two programmes by which you can test whether the electrodes and cables are O.K. During the test, low secure voltage is supplied to the electrodes or cables. Nevertheless, if you accidentally touch both electrodes at the same time you can feel unpleasant itching.

If you select this group, display **TIME (5)** or **(18)** of the appurtenant channel shows the message *tESt* and display **INTENSITY (8)** or **(20)** displays dashes: "**----**". To run the test press button **INTENSITY ▲** or **▼**, **(9)** or **(22)**. Display **INTENSITY (8)** or **(20)** displays the text which characterizes status of the electrodes or of the cable. To stop the test press button **STOP (10)** or **(23)** of the appurtenant channel.
Do not touch both electrodes or metal parts of the banana plugs at the same time!
During the test we therefore recommend to lay one of the electrodes on the table and press the other one gently against.
At the cable test short-circuit both ends of the cables – hold the non-metal parts of the banana plugs.
The following table contains possible test results:

Writing on display INTENSITY	Status of electrodes (program 9811)	Status of the patient cable (program 9812)
Good	the electrodes are O.K.	the cable is O.K.
Poor	the electrodes are still usable	---
bAd	the electrodes are bad	the cable is bad (wire broken)

In case of another result than *Good* we recommend to contact the customer service department of the company stated at the end of this document.

2.4.12 Combined Treatment: Ultrasound – Electrotherapy

Interconnection of the equipment BTL-06 with the ultrasound BTL-07p is described in the User's Manual of BTL-07p.

2.4.13 Use of the Vacuum Unit BTL-12 for Attachment of Electrodes

Interconnection of the equipment BTL-06 with the vacuum unit BTL-12 is described in the User's Manual of BTL-12.

2.5 User Setup *(Setup User – Su)*

This function enables settings and change of some user parameters of the equipment.
To enter the user menu press the buttons **(13)** and **(16)** at the same time – this is possible only if there is no generation on any channel. The **PROGRAMME** display **(1)** displays the text *Su00*. By the buttons **(15)** and **(16)** set the required function *Su00* to *Su11*. The **TIME A** display **(5)** displays the auxiliary text and the **INTENSITY A** display **(8)** shows the set values of the appurtenant function.
To save the selected parameters press the **STOP A/ENTER** button **(10)** for a longer time. The **INTENSITY A** display **(8)** shows the text *Stor* for a short while and the sound signal announces saving of the set values.

If you do not save the changed parameter, the last saved parameter will remain set after you leave the pertinent user function.
To leave the user menu press the button **(14)**.

2.5.1 Change of the Access Code (user function Su00)

The **TIME A** display **(5)** of channel **A** shows the text *CodE*, display **INTENSITY A (8)** displays the set access code. By the buttons **(6)** and **(9)** set the new code. Buttons **TIME A ▲/▼ (6)** serve for setting of the first two digits of the access code and buttons **INTENSITY A ▲/▼ (9)** for setting of the third and the fourth digit access code. To confirm the set access code press the **STOP A/ENTER** button **(10)**. On the **INTENSITY A** display **(8)** the message *Stor* is flashing and the sound signal confirms saving of the set access code. If you do not save the new code, the last saved access code remains active.
This process can be also used for detection of the forgotten code. After switch-on of the main switch – to position "**1**" – press the buttons **(13)** and **(16)** simultaneously and you will get directly to the user menu. Here you can read or change the current access code. After leaving the user menu by button **(14)** the equipment asks for the access code again.
If you set the zero access code *0000* (preset from the manufacturing) the equipment is always unlocked and does not require the access code at start.

2.5.2 Setting of the Sound Mode (user function Su01)

The **TIME A** display **(5)** of channel **A** displays the text *Snd*, display **INTENSITY A (8)** displays the symbol of the selected sound mode of the equipment.

sound mode	text on the INTENSITY display	function
sound	*bEEP*	sound signalling at operation is on
silence	*OFF*	sound signals are minimized

For setting of the required sound mode use buttons **INTENSITY A ▲/▼ (9)**; to save the set mode press the **STOP A/ENTER** button **(10)**.
The *bEEP* mode is preset from the manufacturing.

2.5.3 Setting of the Sound Type of the End of Therapy (user function Su03)

The **TIME A** display **(5)** of channel **A** displays the text *Endt* and the **INTENSITY A** display **(8)** displays the number of the selected sound which announces the end of the therapy to the attendant. The equipment provides thirteen different themes which are stored under numbers "00" – "12". For setting of the required theme use buttons **INTENSITY A ▲/▼ (9)**. You can test it by pressing the **STOP B** button **(23)**. To save your selection press the **STOP A/ENTER** button **(10)**.
Theme 01 is preset from the manufacturing.

2.5.4 Setting of Brightness of the Display (user function Su04)

The **TIME A** display **(5)** of channel **A** displays the text *diSP*, the **INTENSITY A** display **(8)** displays the number of the set brightness of the display. The equipment provides 8 levels of brightness. For comparison of the individual brightness levels, all indication elements in the lower half of the panel are fully shining in this mode. For setting of the required brightness of the displays use buttons **INTENSITY A ▲/▼ (9)**. To save your selection press the **STOP A/ENTER** button **(10)**.

2.5.5 Setting of Brightness of the Indicator Lights (user function Su05)

The **TIME A** display **(5)** of channel **A** displays the text *Indi*, the **INTENSITY A** display **(8)** displays the number of the set brightness of the indicator lights. The equipment provides 8 levels of brightness. For comparison of the individual brightness levels, all indication elements in the lower half of the panel are fully shining in this mode. For setting of the required brightness of the indicator lights use buttons **INTENSITY A ▲/▼ (9)**. To save your selection press the **STOP A/ENTER** button **(10)**.

2.5.6 Setting of Brightness of the Bar Graph (user function Su06)

The **TIME A** display **(5)** of channel **A** displays the text *bAr*, the **INTENSITY A** display **(8)** displays the number of the set brightness of the bar graphs. The equipment provides 8 levels of brightness. For comparison of the individual brightness levels, all indication elements in the lower half of the panel are fully shining in this mode. For setting of the required brightness of the graphs use buttons **INTENSITY A ▲/▼ (9)**. To save your selection press the **STOP A/ENTER** button **(10)**.

2.5.7 Overwriting of the User Settings by the Default Values (user function Su07)

This function serves for deletion of either all or the selected values from the equipment's memory and their replacement by the default values from the manufacturing.

Display **TIME A (5)** of channel **A** displays the text *CLr*, display **INTENSITY A (8)** displays four dashes: **----**. By buttons **INTENSITY A ▲/▼ (9)** set the symbol of the memory area you want to clear on display **INTENSITY A (8)**. To clear this memory area press the **STOP A/ENTER** button **(10)**. During clearing the message *Stor* is displayed and the bar graph **(11)** is flashing.

symbol of the memory area	function
I-t	clears the recorded I-t curves (group 05)
SEq	clears the programmed sequences (group 19) and replaces them by the preset sequences from the manufacturing
PrOG	clears the programmed courses (group 99) and replaces them by the preset courses from the manufacturing
ALL	clears all the above stated, i.e. I-t curves, sequences and courses

2.5.8 Setting of the Patient Circuit Check (user function Su10)

The **TIME A** display **(5)** of channel **A** displays the text *PAti*, the **INTENSITY A** display **(8)** displays the status of the function of patient circuit check. If you set *On* the function is on, *OFF* disables this function. The description of this function is in paragraphs **2.3.8 Check of the Patient Circuit at Setting of Intensity**, **2.3.9 Check of the Patient Circuit during Therapy**.
For setting of *On / OFF* on the **INTENSITY A** display **(8)** use buttons **INTENSITY A ▲/▼ (9)**; to save the option press the **STOP A/ENTER** button **(10)**.
From the manufacturing the mode of the patient circuit check is *On*.

2.5.9 Setting of the Continuity of Sequences (user function Su11)

The **TIME A** display **(5)** of channel **A** displays the text *SEqi*, display **INTENSITY A (8)** displays the status of the sequences continuity function. If you set *On* the function is on, *OFF* disables it. The description of this function is in paragraph **2.4.9 Programmable Sequences (Cocktails) (group 19)**.
For setting of *On / OFF* on the **INTENSITY A** display **(8)** use buttons **INTENSITY A ▲/▼ (9)**; to save the option press the **STOP A/ENTER** button **(10)**.
From the manufacturing the mode of the continuity of sequences is *On*.

2.6 List of Error Messages

If the equipment finds out any problem during the self-test after start or during the work, the **TIME** display shows the text *Err*, display **INTENSITY** displays the error number and the equipment locks in the secure state. In such a case please contact the customer service department of the company stated at the end of this document. The following error messages are the exceptions:

Err 100:
After switch-on of the equipment a button was pressed; it may be caused by the attendant's mistake or by jamming of the button. Unblock the button or contact the customer service department of the company stated at the end of this document.

Err 601:
The maximum allowed value of current was exceeded on the concerned channel. The equipment activated the internal protection system and disconnected the patient. Shut off the equipment, wait for 3 seconds and then switch on again.

Err 602 or Err 603:
An error occurred on the appurtenant channel. This channel now cannot be used for more generation, but on the other channel you can generate. Please contact the customer service department of the company stated at the end of this document.

Err 604:
The maximum allowed temperature of the cooler was exceeded on the concerned channel. Shut off the equipment and wait at least 15 minutes until it cools down. Before restarting check if the equipment is in sufficient distance from any heat source and out of reach of sunbeams and that the output electrodes are not short-circuited.

Err 605:
The synchronization path between both channels is bad – necessary for synchronization of the phase and the amplitude of the rotating field. These current groups (20 – 25) cannot be used, the other ones work. Contact the customer service department of the company stated at the end of this document.

2.7 Possible Faults, and How to Fix Them

Intensity of current in the current mode cannot be set higher than approx. 1.0 – 4.0 mA. If you try to increase the intensity, the displays of the appurtenant channel twinkle and the pilot light CONTACT (17) is shining:

the patient circuit interrupted – possible causes:

- the connector of the cable has bad contact with the connector of the equipment, try to plug it in again
- the electrodes are badly attached to the patient's body
- the electrode sponge covers are not sufficiently moistened
- faulty cable, perform the cable test according to Section **2.4.11 Test of Electrodes and Cables (group 98)**
- worn-down electrodes; perform their test according to Section **2.4.11 Test of Electrodes and Cables (group 98)**

Intensity of voltage in the voltage mode cannot be increased to the required value, the whole bar graph is shining and voltage is permanently being automatically restricted.

possible causes:

- the electrodes are short-circuited – there occurred e.g. an accidental contact between the moistened sponge covers

The sufficient value of intensity cannot be set (at increasing of intensity a value remains on the INTENSITY display and it is impossible to get higher), at the same time the CONTACT pilot light (17) of the appurtenant channel is shining):

This situation may occur in case that the patient circuit's resistance is too high. Possible causes:

- the electrodes are badly attached to the patient's body
- the electrode sponge covers are not sufficiently moistened
- worn-down electrodes; perform their test according to Section **2.4.11 Test of Electrodes and Cables (group 98)**

During generation in the current mode, the set value of intensity decreases or the intensity drops to zero and the CONTACT pilot light (17) of the appurtenant channel is shining:

This situation occurs when the electric circuit is open or the patient circuit's resistance increases during therapy. See points **1** and **3**.

During generation in the voltage mode, the voltage displayed on the INTENSITY display decreases to a lower value than set; during the decreasing the CONTACT pilot light (17) of the appurtenant channel is shining:

The electrodes are short-circuited (connected). See point **2**.

After switch-on of the mains switch, the TIME displays show the text *Err* and the INTENSITY display displays the error number:

The self-test detected the wrong function of the appurtenant channel. It is impossible to generate from this channel, but the other one can be used. In such a situation please contact the customer service department of the company stated at the end of this document.

2.8 Maintenance and Transport

The inspection of the equipment including measuring of all its parameters and possible adjustment must be performed in intervals shorter than 30 calendar months. The inspection is performed by the manufacturer on the basis of the user's order. If the inspection is not performed in the specified term the manufacturer does not guarantee the technical parameters and secure operation of the product.

Keep the equipment clean, do not store it and use for a long time in excessively dusty environment, do not dip it into any liquid. Before every use check if the equipment is not mechanically or otherwise damaged. Do not use the damaged equipment!

2.8.1 Cleaning of the Equipment's Surface and Parts

Clean the equipment and its parts only with a slightly damped soft cloth. For damping use water or a detergent solution. Do not use preparations containing alcohol, ammonia, benzine, thinners, etc.
We recommend to wash the electrode sponge covers at least 2x a week by the 0,5 % solution of a sterilization solution.
No part of the equipment needs to be aseptic or sterilized.

2.8.2 Replacement of Fuse

The fuse **(28)** is located on the rear panel in the round black box. Before replacement first make sure that the mains switch is in position "**0**", for safety's sake disconnect the mains cable from the equipment. Using a fitting screwdriver or coin turn left the segment of the fuse box and put the fuse out. Insert the new fuse and complete the replacement in the same way to the right. **It is forbidden to insert a fuse with another indication than stated on the type label (30) below the fuse box.**
This action may be performed only by a person who is acquainted with this procedure!

2.8.3 Switching the Equipment to other Mains Voltage

The mains voltage switch **(29)** is located on the rear panel. Before switching first make sure that the mains switch is in position "**0**", for safety's sake disconnect also the mains cable from the equipment. Make sure that the fuse in the fuse box has the correct values for the appurtenant voltage (see the type label **(30)** below the fuse). Using a fitting screwdriver or a coin turn the switch segment so that the arrow points at the indication on the switch corresponding to the local mains voltage.
This action may only be performed by a person who is acquainted with this procedure! In case of uncertainty contact the serviceman. The manufacturer takes no responsibility for damages caused by incorrect switching.

2.8.4 Transport and Storage

We recommend that you keep the package of the equipment. For transport it is necessary to pack the equipment in this package which provides its maximum protection. Disconnect the supply cable of the equipment and the patient cables (electrodes). Avoid any bigger shocks. The equipment shall be stored / transported only on conditions defined in Section **3 Technical Parameters.**

If the equipment's lifetime has already expired and the equipment is functionless and unrecoverable and you will not use it anymore, it can be discarded in a way which is usual for this type of devices. The equipment does not contain any toxic materials which could harm the environment at a normal way of liquidation.

2.9 Safety Precautions

ATTENTION!
Applied part of the type BF. In the connectors of this equipment there can be connected only the accessories supplied or recommended by the manufacturer of BTL-marked devices. If the yellow indicator light in the bar graph is shining there may be danger voltage on the output. Be particularly careful.

Safety Provisions:

- Before first switch-on of the equipment read carefully the User's Manual.
- All staff which will use the equipment must be instructed by a responsible person as for the way of use, maintenance and checking of the equipment and the principles of its safe operation.
- We recommend to inspect the equipment thoroughly once a month (slack cables, broken insulation of cables, functions of displays, etc.) and in case of shortcomings contact the serviceman. Use the equipment only if it is not mechanically or otherwise damaged or wet and does not show any differences from the correct function described in the Manual.
- If the equipment shows any defect or if you have doubts about its correct function, terminate the therapy immediately. If you do not determine the source of uncertainty after thorough study of the Manual, contact the customer service department of the company stated at the end of this document.
- If the equipment is used out of accord with this Manual or is used even if it shows functional differences from this Manual, the user is responsible for the damages caused by the equipment!
- Do not cover the air vents of the equipment and do not lay it on a soft pad which could obstruct the access of air from bottom of the equipment.
- Connect only the accessories supplied or recommended by the manufacturer of BTL-marked devices, see list in Section **2.12**

Accessories.

- At switching the mains switch on / off the patient must not be connected to the electrodes. Connect the patient only when the mains switch is on and the pilot light **READY (17)** is shining. If the message **Err** is shining on the equipment's display, immediately disconnect the patient and turn the equipment off. For details see **2.6 List of Error Messages**.
- During generation do not remove the electrodes from the patient's body, first terminate the therapy by the **STOP A/ENTER** button **(10)** for channel **A** or **STOP B (23)** for channel **B**.
- Rinse the electrode sponge covers thoroughly before first use! From the manufacturing they are impregnated by special substance which prevents them from hardening.
- Before start of the therapy check if all set parameters correspond to your requirements.
- Never apply the therapeutic currents on damaged skin!
- Patients with implanted electronic devices (e.g. pacemakers) should be thoroughly examined by a cardiologist before the electrotherapy, who should commend their treatment.
- Be particularly careful at electrotherapy of patients with metal implants.
- The simultaneous application of electrotherapy by BTL-06 and other medical equipment which is not stated in this Manual may cause damage to BTL-06 and possibly even damage to the patient's health.
- Placing of BTL-06 close to short-wave and micro-wave medical devices (e.g. diathermy, hyperthermy...) may cause instability on the output of BTL-06.
- The time delay between switching the equipment off and then on again must be at least 3 s.
- At operation of the equipment keep all valid standards and legal provisions related to operation of the equipment.
- The electrical cabling which the equipment will be connected to must be installed according to the existing valid standards and must be tested according the standards. If you are not sure that the mains is completely OK get it inspected by a inspection engineer.
- Check if the parameters of the mains correspond to the requirements of the equipment according to Section **3 Technical Parameters** and if the voltage switch on the rear panel of the equipment is switched to the correct voltage according to the parameters of the mains.
- The equipment is intended for work in the environment defined in Section **3 Technical Parameters**. It must not be used in different environment, e.g. environment which implies the danger of explosion or penetration of water into the equipment.
- Do not dismantle the equipment in any case, removal of security covers implies the danger of electrical accident.
- All material and parts which come to direct contact with the patient's body as well as the application anode and cathode solutions must fulfil the appurtenant standards related to irritability, allergization, toxicity, genotoxicity, carcinogeneity according to the standard ISO 10993-1. The user is responsible for all these materials and parts which has not been supplied by the manufacturer of BTL-marked devices.

2.10 Useful addresses

The product is manufactured in accordance with the EU Medical Devices Directive by :

BTL Industries Ltd.
Suite 401 Albany House
324-326 Regents Street
London, W1B 3BL United Kingdom
E-mail: sales@btlnet.com
http://www.btlnet.com

For service, please contact service department at service@btlnet.com.

2.11 Warranty

The Manufacturer of this product warrants the product to be free from defects in workmanship and material for a period of twelve months after the date of shipment from the factory. This warranty excludes any disposable items and accessories, including, but not limited to cables or leads, power cords and electrodes. The manufacturer agrees to correct such defects without charge, or at its option to replace the item with a comparable model. To register and be eligible for warranty service, you must send or fax the fully completed warranty registration form within 30 days of

installation. All costs of shipment are the responsibility of the purchaser. Damage to any part such as by accident or misuse or improper installation or by use of any accessories or abrasive material not produced by the Manufacturer is not covered by this warranty. Because of varying climatic conditions, this warranty does not cover any changes in finish, including rusting, pitting, corrosion, tarnishing or peeling. Servicing performed by unauthorized persons render this warranty invalid. There is no other express warranty. The Manufacturer hereby disclaims any and all warranties, including but not limited to, those of merchantability and fitness for a particular purpose to the extent permitted by law. The duration of any implied warranty which cannot be disclaimed is limited to the time period as specified in the express warranty. The Manufacturer shall not be liable for incidental, consequential, or special damages arising out of, or in connection with product use or performance except as may be otherwise accorded by law.

This warranty may differ from the warranty terms and conditions provided by your supplier and by applicable laws in your country.

2.12 Accessories

The equipment is not intended for use in conjunction with other medical devices expect those stated in the Manual.

2.12.1 Basic Accessories

equipment BTL-06 – control unit
mains cable
2 patient cables – black and white
4 electrodes 8 x 6 cm
4 electrode sponge covers 8 x 6 cm
set of belts
1 spare fuse

2.12.2 Additional Accessories – Optional

2 electrodes 6 x 4 cm
2 electrode sponge covers 6 x 4 cm
2 electrodes 12 x 8 cm
2 electrode sponge covers 12 x 8 cm
point-contact electrode
interconnection cable for the combined therapy

3 TECHNICAL PARAMETERS

Design of the Equipment	
- weight - device only	4,8 kg ± 10 %
- dimensions (l x w x h)	225 x 375 x 110 mm ±3 %
- covering grade according to EN 60529	IP20
- class according to NV 180 (93/42EHS)	IIb
- type of the applied part	BF
- operation mode	continuous
Operating Conditions	
- ambient temperature	+ 0 °C to + 40 °C
- relative air humidity	30 % to 75 %
- atmospheric pressure	700 hPa to 1060 hPa
- position	horizontal on legs
Storage Conditions	
- ambient temperature	- 10 °C to + 55 °C
- relative air humidity	25 % to 85 %
- atmospheric pressure	650 hPa to 1100 hPa
- position	any
- maximum duration	1 year
Transport Conditions	
- ambient temperature	- 10 °C to + 55 °C
- relative air humidity	25 % to 85 %
- atmospheric pressure	650 hPa to 1100 hPa
- position	any
- maximum duration	1 year
Power Supply	
- voltage	AC ~198 V to ~252 V, AC ~100 V to ~126 V – switched over
- frequency	50 Hz – 60 Hz
- input	max. 60 VA
- equipment class according to ČSN 33 0600	II
- appliance inlet type	Euro 2 poles
- transformer fuses	
- external	tube fuses 5x20mm, according to IEC 127-2
- pro 230V	1xT315mA
- pro 115V	1xT630mA
- internal (transformer)	1xT1,25A, 4xT400mA, 4xT100mA
- internal (applied part)	2xF160mA, tube fuses 5x20mm, according to IEC 127-2
Insulating Barriers	
- mains - applied part	4 kV
- mains - device frame	4 kV
- device frame - applied parts	3 kV
- applied parts mutually	3 kV
Program	0000 – 9999, step: 1
Therapy Time	00:30 – 60:00 min., step: 30 seconds
- accuracy of the therapy time	± 2 % of the set value
Intensity	± 0,0 – 19,9 mA/V, step: 0,1 mA/V ± 20 – 140 mA, step: 1 mA ± 20 – 100 V, step: 1 V

Accuracy of the Output (at nominal load)	
- setting of intensity	± 10 % of the set value (applies for values from 5 mA/V up); otherwise ± 30 %
- time of parameters of current	± 10 % (applies at nominal impedance and max. intensity)
- frequency of the generated currents	± 10 % (applies at nominal impedance and max. intensity)
Maximum Output Current	± 140 mA (depends on the chosen current type according to IEC 601-2-10)
Maximum Output Voltage	± 110 V (if the value of output current according to IEC 601-2-10 is not exceeded)
Nominal Load Impedance	500 Ω
Output Resistance in the Voltage Mode	100 Ω ± 10 %
Output Resistance in the Current Mode	47 kΩ ± 10 %
Internal Capacity of Output	typically 400 pF
The equipment complies with and is classified according to the following standards:	EN 60601-1, incl. Amendments A2, A11, A12 EN 60601-1-2 EN 55014 EN 55011 EN 60601-1-4 EN 1441 EN ISO 10993-1 IEC 601-2-10
Indication of Power-On (green)	pilot light **READY** on the front panel of the equipment
Indication of Operation (yellow)	bottom LED of the bar graph of the appurtenant channel **A** or **B**
Indication of Opening of the Patient Circuit (yellow)	Pilot lights **CONTACT A** and **CONTACT B**
Positions of the mains switch are marked	**0**/**1**
Compatible with	BTL – 07p BTL – 12

4 USER'S GUIDE

The authors of this User's Guide realize that such a small space is not sufficient for detailed depiction of all problems of electrotherapy. That is why they had to make some generalizations and simplifications which correspond to this length of text. For more details consult the available literature – see the list in Section **4.4 Bibliography**.

4.1 General Effects of Electrotherapy

Electrotherapy is one of widespread types of the physical therapy (PT); at correct indication it is very effective but not universal. It cannot be removed from the context of the physical therapy as a whole, neither regarded as a cure-all.
Most of the physical procedures have similar effects and, according to the parameters, some of them may be dominant. The main effects are:

analgesic effect,
spasmolytic effect,
trophic and antioedematous effect.

By selection of a procedure and its parameters you select one of the above stated effects or their possible combination.

4.2 Classification of Currents to Be Used in Electrotherapy

4.2.1 Galvanic Current

Galvanic current (or "continuous") is current of constant intensity (its program number in BTL-006 is 0001). It is always DC. It is used mostly for iontophoresis, less often its trophic stimulative (hyperaemic) effect is utilized. A big disadvantage of the galvanic current is the risk of chemical damage of the tissue under the electrodes. The damage may be caused by the hydrochloric acid originating under the anode or by the soda lye originating under the cathode. Similar danger of the tissue damage applies also for any direct current (e.g. diadynamic). Direct currents must not be used for the patients with metallic implants!
At present this current is often substituted by galvanic intermittent current (program 0011). This current has the same effects (galvanic component of this current is 95 %) but thanks to the added slight AC component it is better tolerated by the patients. It is suitable especially for the iontophoresis.

4.2.2 Direct Current

Direct current is current of variable intensity but the only one polarity. The basic pulse shape may be very various. It includes e.g. diadynamics (current groups 01, 31 – 33), rectangular, triangular and exponential pulses of one polarity (groups 02, 05, 06, 60, 63, 66 and 69).
In dependence on the used frequency and intensity it has the stimulation, trophic and analgesic effects. Generally, direct current with variable intensity implies the same risks as galvanic current (corrosion of the skin surface) and therefore it requires careful observance of correct procedure, especially the applied intensity.
The main is the stimulation effect which is important especially below the cathode – green negative electrode.
It is suitable to choose some of these currents (especially the high-power) as so-called intermittent, similarly as for the galvanic current. It is again for better tolerance by the patient. It applies for currents 0012 - 0015, groups 31 and 33.

4.2.3 Alternating Current

Alternating current is safer, more effective and better subjectively tolerated by the patient. The basic pulse shape again may be very various – rectangular (e.g. groups 03, 04), triangular (e.g. groups 63 – 65), exponential (e.g. 66 – 71) and combined (e.g. groups 72). It can be either symmetric (e.g. groups 03, 04) or asymmetric (groups 72). However, the DC component is always zero. Therefore there does not occur any chemical damage of the skin under the electrodes.
Thus it enables also long-lasting applications, even for the patients with metal implants. Nowadays the low-power pulses – TENSes and interferences – assert themselves among the alternating currents.
In general:

fast rise of pulses increases their effectiveness,
short duration of the pulse improves the subjective perception,
the zero average value (DC component) is a prevention from chemical damage of the tissue
frequency and amplitude are responsible for the required therapeutical effect.

4.2.3.1 TENS currents

TENS = **t**ranscutaneous **e**lectrical **n**erve **s**timulation
Nowadays very prevalent group of currents which substitutes the standard applications of diadynamic currents, Russian stimulation, etc. TENS pulses are low-power and have the zero DC component. Therefore besides suppression of chemical damage of the tissue, the risk of electric damage of the tissue is also minimized.
As can be seen from their name, these currents are intended for excitation of nerve fibres. Their major utilization is in the area of alleviation of pain, inhibition of itching, etc. For more details see Section **5 Some Recommended Types**

of Electrotherapy for Particular Diagnoses. The mechanism of their effect is most often explained by the so-called gate theory of pain.
In the equipment they are stored under groups 10 – 19 40 – 57.

4.2.3.2 Classic four-pole interference (groups 08, 26)

Four electrodes are located crosswise. Two frequency signals with different frequencies f_A and f_B are brought to the tissue. Their interference in the tissue induces a low-frequency surge of the following frequency in the centre of the cross:

$$AMF = f_A - f_B.$$

By changes of the frequency f_B, the frequency AMF can be changed to the frequency AMF + Spectrum (frequency modulation). So, its effects are similar to those of the low-frequency currents, although it is carried by current of higher frequency. The carrier frequency of channels ranges from 2 to 10 kHz. The higher its frequency, the better it is tolerated by the patient.
The advantage of the four-pole interference is the in-depth aiming of the area being cured and lower stress on the superficial skin. Therefore there can be set higher intensity values than for the two-pole application.

4.2.3.3 Two-pole interference (groups 09, 27)

The resulting low-frequency current of the frequency AMF (or AMF + Spectrum) is created by the equipment. So, two electrodes are sufficient for its application. The intensities that can be reached are lower than for the classic interference, and stress of the superficial tissue is similar to that of the other low-frequency currents.
Its advantage is that it can be applied by the point-contact electrode.

4.2.3.4 Isoplanar vector field (groups 20 and 21)

A special form of the four-pole interference where the additional modulation of both channels enables to distribute the area being cured to the whole area of the current circuits' interlacement. It implies that placing of individual electrodes is much easier – those do not need to form a perfect cross anymore. The effect of these currents is very diffuse, in-depth and delicate.

4.2.3.5 Dipole vector field (groups 22 – 25)

The additional phase and amplitude modulation of basic signals of the four-pole interference here enables to achieve the only one direction of the electric field's acting (so-called dipole arises in the tissue). In the direction of this dipole, the modulation of the field is 100 %, in the other directions it is almost zero. You can either rotate this dipole (abscissa) manually, and thus precisely aim the required effect of the therapy, or let it rotate automatically.

4.3 Effects of electrotherapy

4.3.1 Analgesic effect

Pain is a multi-factor phenomenon and the practice positively shows that various types of pain react more or less good to various physical-therapeutic, i.e. also electrotherapeutical procedures. There are several mechanisms of the analgesic effect of electrotherapy – besides the well-known *gate theory* of pain there is also proven increase of the *production of endorphins* and analgesic effect of *myorelaxation* which results from removal of contractures, and the analgesic effect which results from *favourable trophic effects*.
Since the analgesic effect of electrotherapy is fundamental and most utilized, it shall be described in a little bit more details:
Pain is usually simply defined as an unpleasant sensuous and emotional experience connected with current or potential damage of tissue. We usually discriminate between acute and chronic pain. The acute pain is short-lasting (maximum several days or weeks). It is caused by a mechanical damage of the tissue or by a disease, comes immediately after a painful stimulus and – after its ending – it wanes; the intensity of pain depends on the intensity of the stimulation. On the other hand, chronic pain is long-lasting (more than 3 months), or it recurs; its intensity depends on the intensity of the stimulation, and emotions particularly play a leading role.
The current generally accepted theory of perception of pain is based on the assumption of existence of a specific sensory system which transfers information from receptors of pain on the periphery to the centre of pain in the central nervous system by preformed specialized nerve paths. However, the process in fact is much more complicated and persons interested can learn about it from the available specialized literature.
To understand the effects of electrotherapy it is important to understand especially the modulation factors which can influence the perception and transfer of the painful stimulus:
First crucial modulation factor is described by the so-called gate theory of pain which is based on the presumption that the nervous mechanism in posterior medullary horns act as a small gate which lets through only limited flow of nervous impulses from the peripheral afferent fibres to the central nervous system, according to how much they are opened. Stimulation of some particular fibres can modulate the extent of the gate's opening or closing for pain and thus also increase or decrease transfer of the nociceptive information.
Second important modulation factor is described by the neuromodulation theory which is based on the analgesic effect of some substances belonging to the group of so-called neuromodulators, especially endorphins and encephalins. These substances are produced in the central nervous system and according to the mentioned theory they have crucial importance especially for subjective perception of pain.
Anyway, the analgesic effect of electrotherapy is used most often. To make PT a real benefit for the patient, it is necessary to observe the following conditions:

Do not suppress the signalling and protective function of pain (which is especially important for acute pain!), i.e. at first decrypt the information being signalled by *the pain, properly determine the diagnosis or at least a preliminary hypothesis and only then intervene against the pain. Pain modified by PT or analgesics can loose its specificity insomuch that later it cannot be decrypted.

Together with application of the analgesic PT you should considerably reduce administering of analgesics. This condition is very important, owing to the possibility of relatively precise aiming of the analgesic effect of PT (in contrast to the unaimed effect of medicaments) and possible undesired interaction between PT and medicaments.

Select the type of PT with respect to the expected effect (gate theory, endorphins).

For the chronic or recurrent complaints do not obstinately apply various types of PT, but examine the locomotive system or get it examined by a specialist – very often the source of these complaints is far from the place of projection of pain (catenating).

For stimulation of thick, myelinized nerve fibres of the type A alpha (gate theory) it is optimal to use low-frequency currents with the frequency 50 - 150 Hz, and threshold-sensitive to threshold-motor intensity. This method is effective especially for acute and segmentally localised pains. For stimulation of thin fibres of the C type (creation of endorphins) it is most suitable to use the frequency 2 - 8 Hz and the intensity at the highest tolerable level. This method is recommended especially for chronic painful syndromes. Therefore, for the mostly analgesic effect, it is suitable to choose e.g. diadynamic LP current or bipolar amplitude-modulated mid-frequency current or inter-frequency currents with the required frequency, or TENS.

By the depth of the required effect we can sort the procedures with the analgesic effect from the most superficial to the deepest – the asterisk in the program number indicates a variable value:

analgesic effect of anelectrotonus (prog. 0001, 0011)

diadynamic currents LP and CP-ISO (prog. 014* a 016*, 3*4* and 3*6*)

Träbert current (prog. 0002, 0012)

TENS (prog. 1*11, 1*12, 1*14, 1*22, 1*23, 1*25, 1*3*, 4*11, 4*12, 4*14, 4*22, 4*23, 4*25, 4*3*, 5*11, 5*12, 5*14, 5*22, 5*23, 5*25, 5*3*,)

amplitude-modulated currents with suitable frequency modulation (prog. 09*4, 09*5, 09*6, 27*4, 27*5, 27*6)

interference and vector fields (prog. 08*4, 08*5, 08*6, 2**4, 2**5, 2**6)

4.3.2 Myorelaxation and spasmolytic effect

Especially after the posturographic examination had proved that overall administering of so-called myorelaxancies has a negative long-term influence on the body posture, the possibility of exact aiming on hypertonic or spastic muscles has been regarded as an especially valuable advantage of the myorelaxation procedures. At global application of myorelaxancies there are firstly affected the phasic muscles which have been already weakened due to the layer syndrome. Later, or when stronger dose is applied, there are also affected the tonic muscles and only at the end, at the strongest dosage, also spastic muscles are positively affected. This effect lasts for several weeks and affects the static of the spine very negatively even after the acute complaints have subsided.

Procedures with myorelaxation effect include ultrasound, amplitude-modulate mid-frequency currents with the frequency of the envelope 100 – 200 Hz (prog. 09*7, 27*7), interference currents in the same band of the frequency modulation (prog. 08*7, 2**7) and, for small superficial muscles especially on hands, also paraffin.

A favourable side effect of the myorelaxation effect is also the analgesic effect.

4.3.3 Trophic effect

is caused by hyperaemia which occurs almost at all types of PT (except cryotherapy). Since the mechanism of hyperaemia at various types of PT is different, it is necessary to take these mechanisms into account to be able to select the particular PT. Generally, galvanization can be recommended (prog. 0001, 0011), especially lengthways (capillary hyperaemia, vessel eutonisation), low-frequency currents of the frequency 30 - 60 Hz (prog. 013*, 016*, 0*3*, 08*2, 08*4, 09*2, 09*4*, 1*13, 1*24, 2**2, 4*13, 4*24) and the intensity at or above the threshold motor level (muscle micropump) or ultrasound, laser, polarized specified achromatic light, vacuum-overpressure therapy, etc.

The trophic effect may be partly caused by the fact that most forms of PT, esp. laser, biolamp and magnetotherapy, bring energy into the organism, that can be used by cells (or other structures) for their activity.

The trophic hyperaemic effect is also usually connected with the analgesic effect.

4.3.4 Antioedematous effect

is practically connected to hyperaemia, vessel eutonisation and higher capillary permeability. Therefore the therapies referred to as trophic are also antioedematous (see the previous paragraph).

4.3.5 Placebo effect

Objectors of the physical therapy tend to refer to its effects as placebo.

If the PT is applied accidentally, without knowledge of its mechanism, accurate aiming and dosage (as it often happens), its effects can be called like this. Exact verification of effects of PT faces many troubles.

Owing to the fact that *lege artis* application of PT requires to take into account especially the patient's individuality and momentary functional status (including the limbic system status, mood, muscular tonus, season of the year,

weather, motivation, attitude to troubles, etc.), it is almost impossible to create a group for further statistical processing. Creation of a control group is practically out of question.

The effect of PT lies almost only in affecting of the afferent system. The afferent system processes all data, including the visual, auditory, tactile and other analysers. Since very often a slight stimulus is sufficient to deviate the organism from the existing pathological functional balance and, using its enormous self-reparation abilities, the organism helps itself, there cannot be carried out e.g. a blind experiment without at least minimum excitation of an afferent system and/or higher components of CNS.

Functional defects of the locomotive organs which belong to the main positive effects of PT tend to self-repair, if they are not prevented from that (e.g. by inappropriate pharmacotherapy). If correctly indicated, PT both initiates and accelerates this self-reparation, which indeed can be hardly exactly proved.

4.3.6 Deferring effect

A "troublesome" patient is often invited for the check examination only after undergoing of usually ten procedures and "hopefully will be better then". This way of thinking is immoral, unethical and discreditable to a specialist, but nevertheless most of the existing prescriptions of PT unfortunately belong within this category. In some surgeries the patients are even told that the effect of the chosen PT will come only after several months (!), which means that the physician fully relies on the organism's self-reparation abilities.

Indication of PT then should not be based only on the diagnosis, especially if the diagnosis is confusing, e.g. periarthritis humeroscapularis etc.

The attending physician should know the answers to the following questions:

What is the cause of the complaints, usually pains?

Is the defect functional or organic? and where?

Which of the above-mentioned effects of PT is the most important for the patient at this moment?

Is there not a risk of aggravation or organification of the functional defect after the chosen PT?

By these answers the physician should choose the type, location, intensity, frequency and total number of procedures, and, in relation to them, also the date of the check examination of the patient.

4.4 Bibliography

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5 SOME RECOMMENDED TYPES OF ELECTROTHERAPY FOR PARTICULAR DIAGNOSES

Effects of electrotherapy:
A – analgesic, M – myorelaxation, spasmolytic, T – trophic, AE – antioedematous, H – hyperaemic, V – vasodilatation, S – stimulative

5.1 Arteriosclerosis (ischaemic limb disease)

position of electrodes: P,T

TENS burst (100 μs, frequency 100 Hz, burst frequency 1 Hz) - **prog. 1831.**
Time of application 15 minutes.
Intensity above threshold sensitivity.
In case of affection of lower limbs use paravertebral position of two electrodes in the height L4 - S1, for upper limbs use paravertebral position C6 - Th1. This segmental treatment shall be followed by local treatment where either place the affected area (usually fingers) between both electrodes or place one electrode on the affected area on the spine and the other one split into two (to be placed on each limb).

5.2 Arthrosis – oedema dominates

position of electrodes: T

Diadynamic CP-ISO with base 0,5 % - **prog. 0162.**
Time of application 12 minutes, reversal of poles after 6 minutes.
Intensity at or above threshold motor level.
Apply the electrodes in such way that the current flows through the entire joint.

5.3 Arthrosis – pain dominates

position of electrodes: T

2-pole interference (carrier frequency 10 kHz, AMF 60 Hz, spectrum 40 Hz, continuous change 6/0/6) – **prog. 2764**
Time of application 12 minutes.
Intensity at threshold sensitivity.
Place the electrodes in such way that the current flows crosswise through the joint.
or
Träbert current - **prog. 0002.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
Apply the electrodes in such way that the current flows through the entire joint. The primary effect is important – pain subsides immediately after the therapy.

5.4 Arthrosis of shoulder joint, chronic

position of electrodes: T, EL

Träbert current - **prog. 0002.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
Place the electrodes either from the front and from behind of the affected shoulder, or in the vertebral position (classic EL_2 position according to Träbert) – usually brings better results.

5.5 Arthrosis of shoulder joint, subacute

position of electrodes: T

2-pole interference (carrier frequency 4 kHz, AMF 100 Hz, spectrum 50 Hz, step change 3/3) - **prog. 0926.**
Time of application 12 minutes.
Intensity above threshold sensitivity.
One electrode on the most painful area, the other in such way that the current flows through the entire joint if possible.

5.6 Arthrosis of shoulder joint, subchronic

position of electrodes: K

Isoplanar vector field (carrier frequency 10 kHz, AMF 100 Hz, spectrum 50 Hz, continuous change 6/6) - **prog. 2166.**
Time of application 5 – 10 minutes.
Intensity from above-threshold sensitivity to threshold motor level.
Electrodes of the A circuit shall be placed from the front and from behind of the shoulder, one electrode of the B circuit on m. deltoideus, the other above acromion.

5.7 Atonic bladder

position of electrodes: A

4-pole interference (carrier 4 kHz, AMF 1 Hz, spectrum 99 Hz, continuous change 6/0/6) - **prog. 2662.**
Time of application 10 minutes.
Intensity at threshold sensitivity.
One large electrode (approx. 100 cm^2) of the A circuit in the right lumbar area, the other (approx. 50 cm^2) closely above the symphysis, to the left of the middle line. The larger electrode of the B circuit (approx. 100 cm^2) in the left lumbar area, the other (approx. 50 cm^2) closely above the symphysis, to the right of the middle line.

5.8 Cellulitis – deep fat layers

position of electrodes: K

4-pole interference (carrier frequency 10 kHz, AMF 60 Hz, spectrum 40 Hz, continuous change 5/1/5) - **prog. 2654.**
Time of application 15 minutes.
Intensity above threshold motor level, can be increased during application.
All four electrodes on the affected area, intersection of currents from both circuits, best in such way that the large muscles under the affected area are stimulated.

5.9 Cellulitis – superficial fat layers

position of electrodes: V

Diadynamic - two-step application – **prog. 1901**
The application consists of the DF current (prog. 0112, time of application 1 minute, intensity above threshold sensitivity) and the CP ISO current (prog. 0161, time of application 8 minutes, reversal of polarity after 4 minutes, intensity above threshold motor level). The sequence including reversal of polarity is pre-programmed in the program 1901.
Two large electrodes are placed on the area being cured, best in such way that the large muscles under the affected area are stimulated.

5.10 Contracted muscles

position of electrodes: V

Symmetric rectangular pulses (faradization of surge) (frequency 100 Hz, stimulation 5 sec, pause 10 sec) - **prog. 0349.**
Time of application 6 minutes.
Intensity above threshold motor level.
Place two electrodes proximally and distally on the belly of the contracted muscle (muscle group); during the pause the patient exercises active contraction of antagonists. You can support this movement manually. During the application the intensity can be increased, according to the sensitivity.

5.11 Contracture after immobilization

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 30 Hz, spectrum 30 Hz, step change 1/1) - **prog. 0813.**
Time of application 5 - 15 minutes, step 2 minutes.
Place the electrodes so that the currents intersect inside the affected joint. Intensity above threshold sensitivity, up to the highest tolerable level.

5.12 Contracture after immobilization

position of electrodes: K

2-pole interference (carrier frequency 4 kHz, AMF 30 Hz, spectrum 30 Hz, step change 1/1) - **prog. 0913.**
Time of application 10 - 20 minutes, step 2 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
Place the electrodes so that the current flows through the joint. This modulation affects particularly the deep structures - articular capsules, ligaments.

5.13 Coxarthrosis

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 60 Hz, spectrum 40 Hz, step change 6/0/6) - **prog. 0834.**
Time of application 10 – 15 minutes.
Intensity from above-threshold sensitivity to below-threshold motor level.
One electrode of the A circuit on the ventrocranial part of the thigh, the other on m. gluteus max. One electrode of the B circuit dorsally from trochanter maior, the other on the inguen.

5.14 Coxarthrosis

position of electrodes: K, A

Isoplanar vector field (carrier frequency 10 kHz, AMF 100 Hz, spectrum 50 Hz, continuous change 6/6) - **prog. 2166.**
Time of application 10 – 15 minutes.
Intensity above threshold sensitivity.

Vacuum electrodes are preferable. Spatial intersection of circuits so that the affected area is in the centre of current paths.

5.15 Coxarthrosis

position of electrodes: T, P

Träbert current - **prog. 0002.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
Segmental application (paravertebrally in the L3-S1 area) or on the affected area. The effect of this current is too superficial, so it cannot act directly inside the joint, but it is used for the speed of analgesia and positive influence on the circulation.

5.16 Distortion, peracute

position of electrodes: T

Galvanic current (resting transverse galvanization) - **prog. 0001.**
Time of application 20 - 30 minutes, step 5 minutes, 3x per day.
Intensity at threshold sensitivity, max. current density 0,1 mA/cm^2.
Both electrodes are applied on the affected joint in the way that the current flows through the entire joint. ***Use of protective solutions is necessary!!***

5.17 Distortion, subacute

position of electrodes: T

Diadynamic – two-step application – **prog. 1902**
Application consists of DF current (prog. 0111, time of application 1 minute, intensity at threshold sensitivity) and CP ISO current (prog. 0161, time of application 8 minutes, reversal of polarity after 4 minutes, intensity at threshold motor level). The sequence including reversal of polarity is pre-programmed in the program 1902.
The electrodes are placed in the way that the affected area is between them. This will enable to increase the resorption of the oedema and to alleviate the pain.

5.18 Distortion, subchronic

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 1 Hz, spectrum 99 Hz, continuous change 5/1/5) - **prog. 0852.**
Time of application 10 - 20 minutes, step 2 minutes.
Intensity at least at threshold motor level, must be increased during the application.
Electrodes around the affected joint, intersection of the current circuits is necessary.

5.19 Enfeebled abdominal muscles

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 30 Hz, spectrum 30 Hz, step change 3/3) - **prog. 0823.**
Time of application 5 - 15 minutes, step 2 minutes.
Intensity at or above threshold motor level.
Electrodes are placed on the abdominal wall so that the currents intersect.

5.20 Enfeebled phasic muscles

position of electrodes: V

Rectangular pulses 1 msec (faradization of surge) (frequency 143 Hz, stimulation 3 sec, pause 6 sec) - **prog. 0255.**
Time of application 10 minutes.
Intensity above threshold motor level (visible muscle contraction). Place both electrodes on the enfeebled muscle.

5.21 Enfeebled tonic muscles

position of electrodes: V

Rectangular pulses 1 msec (faradization of surge) (frequency 50 Hz, stimulation 5 sec, pause 10 sec) - **prog. 0239.**
Time of application 10 minutes.
Intensity above threshold motor level.
Place both electrodes on the belly of the enfeebled muscle. Slowly increase the intensity until you achieve strong contraction.

5.22 Epicondylitis radialis (ulnaris)

position of electrodes: A

2-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, continuous change 5/1/5) - **prog. 0955.**
Time of application 15 minutes.
Intensity at threshold motor level.
One electrode on the radial (ulnar) epicondyle of humerus, the other on the extensor (flexor) muscle group.

5.23 Epicondylitis radialis (ulnaris)

position of electrodes: A

2-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, continuous change 3/3/3) - **prog. 0945.**
Time of application 10 minutes.
Intensity at threshold motor level.
One electrode on the lateral (or medial) epicondyle, the other on the extensor (flexor) muscle group.

5.24 Epicondylitis, bilateral

position of electrodes: A

4-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, continuous change 3/3/3) - **prog. 0845.**
Time of application 10 minutes.
Intensity from above-threshold sensitivity to threshold motor level. One electrode of the A circuit is located on the lateral epicondyle, the other on proc. styloideus radii. One electrode of the B circuit on the medial epicondyle, the other on capitulum of ulna.

5.25 Frozen shoulder

position of electrodes: A

TENS burst (70 μsec, frequency 100 Hz, burst frequency 5 Hz) - **prog. 4832.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
One electrode paravertebrally C6 - Th2, the other on the painful area of the shoulder.

5.26 Frozen shoulder

position of electrodes: A

TENS constant frequency (70 μsec, frequency 100 Hz) - **prog. 4825**
Time of application 15 minutes.
Intensity above threshold sensitivity.
One electrode paravertebrally in the Th3 area, the other on the most painful area.

5.27 Gonarthrosis (chronic)

position of electrodes: K

Manually rotated dipole (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz) - **prog. 2251 – 2256.**
Time of application 20 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level. The electrodes are placed around the joint in such way that the currents of both circuits intersect inside the joint. By sequential choosing of currents (2251, 2252, 2253 ... 2256) "target" the dipole to the patient's maximum perception.

5.28 Haematoma, contusion

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 60 Hz, spectrum 40 Hz, step change 1/1) - **prog. 0814.**
Time of application 5 - 15 minutes, step 2 minutes.
Intensity at or above threshold motor level.
Electrodes around the fluxion, intersection of currents of both circuits.

5.29 Haematoma, contusion

position of electrodes: V

Symmetric rectangular pulses 1 msec, modulated by sine (frequency 100 Hz, stimulation 3 sec, pause 3 sec) – **prog. 0344.**
Time of application 10 minutes.
Intensity at threshold motor level.
Apply the electrodes so that to stimulate fibres of the muscle under the haematoma, one electrode in front of and the other behind the haematoma (in relation to the course of the muscle fibres).

5.30 Herpes zooster

position of electrodes: A

TENS modulated by sine (50 μsec, frequency 50 Hz) - **prog. 1425.**
Time of application 20 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
In this indication the electrodes are applied directly on the affected area, in case of damage of the skin on the vesicle closely above and below it. It is impossible to influence the disease directly, but pain can be alleviated.

5.31 Herpes zooster

position of electrodes: A

Diadynamic CP 4 minutes - **prog. 0131.**
Intensity at the highest tolerable level (below threshold algesic level).
Electrodes above and below outlet of the intercostal nerve, at the next application the exanthema is between the electrodes.

5.32 Hydropsy of joint, haemarthrosis

position of electrodes: T

2-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, step change 1/1) - **prog. 0915.**
Time of application 12 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level. Apply the electrodes opposite each other so that the current flows through the entire joint.

5.33 Hydropsy of joint, haemarthrosis (subacute)

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, step change 1/1) - **prog. 0815.**
Time of application 12 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level. The electrodes are placed around the joint in such way that the currents of both circuits intersect inside the joint.

5.34 Inflammation of shoulder joint

position of electrodes: T

2-pole interference (carrier frequency 10 kHz, AMF 100 Hz, spectrum 50 Hz, continuous change 5/1/5) - **prog. 2756.**
Time of application 12 minutes.
Intensity at or above threshold sensitivity.
Place one electrode on the most painful point, the other in such way that the current flows if possible through the entire joint.

5.35 Iontophoresis

position of electrodes: T

Galvanic current - **prog. 0011.**
Time of application 20 - 60 minutes (according to the stage).
Intensity at threshold sensitivity. maximum current density 0,1 mA/cm^2. Appropriate **protective solution** on the other electrode.

5.36 Lumbago without radicular stimulation

position of electrodes: P

Random TENS (100 μs, frequency 200 Hz) - **prog. 1617.**
Time of application 20 minutes.
Intensity from above-threshold sensitivity to below-threshold motor level.
Place both electrodes paravertebrally in the lumbar area.

5.37 Lumbago without radicular stimulation

position of electrodes: A, EL

Träbert current - **prog. 0002.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
One large electrode (8 x 12 cm) to the L of the spine, the other to the Th-L or S of the spine, according to the direction of the radiation. The patient must feel relief immediately after the treatment (so-called early effect).

5.38 Lumbago without radicular stimulation

position of electrodes: K, A

Isoplanar vector field (carrier frequency 10 kHz, AMF = 70 Hz, spectrum = 70 Hz. continuous change 5/5) - **prog. 2155.**
Time of application 10 – 15 minutes.
Intensity above threshold sensitivity.
Vacuum electrodes are preferable. Spatial intersection of circuits so that the affected area is in the centre of current paths.

5.39 Menstrual pain

position of electrodes: P

Random TENS (100 μs, frequency 50 Hz) - **prog. 1614.**
Time of application 15 minutes.
Intensity above threshold sensitivity.
Two large electrodes on both sides of sacrum. It is suitable to use a vaginal electrode.

5.40 Morbus Bechterevi

position of electrodes: A

2-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, step change 1/1) - **prog. 0915.**
Time of application 12 minutes.
Intensity at the highest tolerable level.
Place one electrode on the area being cured, the other more cranially.

5.41 Morbus Bürger

position of electrodes: A

TENS constant frequency (70 μs, frequency 143 Hz) - **prog. 4826.**
Time of application 15 minutes.
Intensity at the highest tolerable level.
Place one electrode paravertebrally in the L4 - S1 area, the other, split into two, is placed on the left and right buttock.

5.42 Morbus Bürger, ischaemic lower limb disease

position of electrodes: T

Träbert current - **prog. 0002.**
Time of application 15 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level. Anode: in the paravertebral position (or homolateral, in case of unilateral affection) in the Th10-L2 area. Cathode: split into two parts, which are placed on the left and right m. gluteus maximus. Stimulation of afferent fibres in the skin causes inhibition of orthosympathetic fibres and subsequent vasodilatation.

5.43 Morbus Bürger, ischaemic lower limb disease

position of electrodes: A

Diadynamic CP with base 1 % - **prog. 0133.**
Time of application 20 - 25 minutes, step 1 minute.
Intensity at threshold motor level.
Anode (at least 250 cm^2): in the paravertebral position (or homolateral, in case of unilateral affection) in the Th10-L2 area. Cathode: applied on the calf (calves), either split into two (bilateral application) or by one (usual dimensions 7 x 30 cm). Owing to the duration of the application and to the impossibility of reversal of polarity it is necessary to use classic electrode pads and **appropriate protective solutions!**
Application: at the beginning 3x per week, later 2x per week or 1x per week (holding course) for a long term

Note: Step – time step by which the therapies in the stated extent are prolonged.

5.44 Morbus Osgood-Schlatter

position of electrodes: A

Diadynamic – two-step application – **prog. 1903**
The application consists of the DF current (prog. 0112, time of application 1 minute, intensity at or above threshold sensitivity) and the CP ISO current (prog. 0162, time of application 5 minutes, intensity at threshold motor level).
Small electrodes, cathode on tuberositas tibiae, anode closely below patella.
The sequence is pre-programmed in the program 1903.

5.45 Muscular contracture

position of electrodes: V

Symmetric rectangular pulses modulated by half-period of sine (frequency 143 Hz, stimulation 5 sec, pause 10 sec) - **prog. 0359.**
Time of application 6 minutes.
Attach both electrodes proximally and distally on the belly of the muscle. Stretch the muscle passively and increase the intensity to the threshold motor level. Ask the patient to stretch the muscle by contraction of antagonists during the current passage. You can also manually support this movement. If the stretching is perceived more than the current, increase the intensity.

5.46 Muscular distension

position of electrodes: T

2-pole interference (carrier frequency 4 kHz, AMF 100 Hz, spectrum 50 Hz, continuous change 3/3/3) - **prog. 0946.**
Time of application 7 minutes.
Intensity at threshold motor level, do not use for acute states. Place the electrodes on the muscle so that the current flows orthogonally to the course of muscle fibres.

5.47 Myalgia

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 30 Hz, spectrum 30 Hz, continuous change 5/1/5) - **prog. 0853.**
Time of application 8 minutes.
Intensity at or above threshold motor level.
Electrodes are placed so that the whole muscle group (for small muscle groups also the antagonists) is between the electrodes and the current circuits intersect.

5.48 Myalgia – phasic muscle

position of electrodes: V

TENS modulated by sine (100 μs, 3/3 s) - **prog. 1643.**
Time of application 10 minutes.
Intensity at or above threshold motor level.
Both electrodes are placed on the affected muscle so that the current flows along the fibres.

5.49 Neuralgia

position of electrodes: A

TENS constant frequency, , tetrapolar application (30 μs, frequency 100 Hz) - **prog. 4525.**
Time of application 20 minutes, channel A + B.
Intensity above threshold sensitivity (unusual for TENS).
Electrodes of the A circuit paravertebrally, above and below the level of origin of appropriate roots, electrodes of the B circuit shall be placed in the way that the peripheral painful zone is between them.

5.50 Neuralgia

position of electrodes: T

TENS alternating pulses, random (70 μs, frequency 100 Hz) - **prog. 1417.**
Time of application 20 minutes.
Intensity from above-threshold sensitivity to threshold motor level.
Place the electrodes so that the painful zone is between them.

5.51 Occipital neuralgia (tension cephalea)

position of electrodes: A

TENS random (50 μsec, frequency about 100 Hz) - **prog. 1417.**
Time of application 15 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
Two small electrodes on the outlets of n. occipitalis major, closely below linea nuchae superior, well moistened pad.

5.52 Occipital neuralgia (tension, anteflection cephalea)

position of electrodes: K, A

4-pole interference (carrier frequency 4 kHz, AMF 90 Hz, spectrum 60 Hz, step change 6/6 or continuous 6/0/6) - **prog. 0835 or 0865.**
Time of application 12 minutes.
Intensity above threshold sensitivity.
Two electrodes are applied to the most lateral parts of both trapezius muscles, other two above occipital attachments of these muscles (linea nuchae sup.). Circuits A and B must intersect.

5.53 Occipital neuralgia (tension, anteflection cephalea)

position of electrodes: A

TENS burst (30 μs, frequency 100 Hz, burst frequency 10 Hz) - **prog. 4533.**
Time of application 15 minutes.
Intensity at the highest tolerable level (below threshold algesic level).
Two small electrodes above the outlets of n. occipitalis at the lateral side of trapezius muscles, closely below the skull.

5.54 Oedema (non-inflammatory)

position of electrodes: K

4-pole interference (carrier frequency 4 kHz, AMF 60 Hz, spectrum 40 Hz, step change 1/1) – **prog. 0814.**
Time of application 10 minutes.
Intensity from above-threshold sensitivity to threshold motor level.
Electrodes around or on the oedema, circuits intersect.

5.55 Oedema (non-inflammatory)

position of electrodes: T

Diadynamic – two-step application – **prog. 1904**

The application consists of the DF current (prog. 0111, time of application 1 minute, intensity above threshold sensitivity) and CP-ISO current (prog. 0161, time of application 8 minutes, reversal of polarity after 4 minutes, intensity above threshold motor level). The sequence including reversal of polarity is pre-programmed in the program 1904.
Both electrodes directly on the oedema.

5.56 Osteoporosis

position of electrodes: A

TENS random (50 μsec, frequency 500 Hz) - **prog. 1419**
Time of application 20 minutes.
Intensity at (or below) threshold sensitivity
Upper limbs: one electrode paravertebrally C_6 - Th_1, the other on the dorsum of the hand
Lower limbs: one electrode paravertebrally L_4 - S_1, the other on the dorsum of the leg
Spine: one electrode on C spine, the other on sacrum

5.57 Postherpetic neuralgia

position of electrodes: A

TENS burst, tetrapolar application (imp. 50 μs, frequency 100 Hz, burst frequency 10 Hz) - **prog. 1333.**
Time of application 15 minutes.
Intensity at or above threshold sensitivity.
Place the electrodes of the A circuit directly on the affected area, electrodes of the B circuit above and below outlet of the appurtenant intercostal nerve.

5.58 Postherpetic neuralgia

position of electrodes: T

TENS burst (50 μs, frequency 100 Hz, burst frequency 10 Hz) - **prog. 1333.**
Time of application 15 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
Place the electrodes in such way that the current flows through the whole affected area. Stimulation by short pulses stimulates fibres of the A type and thus inhibits conduction of pain through the fibres of the C type.

5.59 Postoperative enfeeblement of muscle

position of electrodes: V

Kotz currents (carrier frequency 2,5 kHz, pulse frequency 50 Hz, pulse/pause 1:1, surge/pause 12/12) - **prog. 0712.**
Time of application 10 minutes.
Intensity at or above threshold motor level.
Two electrodes above the course of the muscle. Instruct the patient to concentrate on what they feel and to exercise active contractions during the stimulation by electric current.

5.60 Postoperative enfeeblement of muscle

position of electrodes: V

2-pole interference (carrier frequency 4 kHz, AMF 100 Hz, spectrum 50 Hz, continuous change 6/0/6) - **prog. 0964.**
Time of application 10 minutes.
Intensity above threshold motor level.
Apply both electrodes on the belly of the enfeebled muscle. During the current passage the patient shall try active contraction.

5.61 Postoperative pain

position of electrodes: V

TENS constant frequency (50 μs, frequency 100 Hz) - **prog. 1525**
Time of application 15 minutes
Intensity above threshold sensitivity.
If possible, place the electrodes proximally and distally from the lesion (observing the sterility rules).

5.62 Postoperative pain

position of electrodes: K

TENS constant frequency, tetrapolar application (70 μs, frequency 100 Hz) - **prog. 4625.**
Time of application 15 minutes.
Intensity at threshold sensitivity, up to the highest tolerable level.
Place the electrodes proximally and distally from the postoperative scar so that the currents of both circuits intersect. Intensity at threshold sensitivity. Sterility rules must be observed. Metal and plastic implants are not contraindicated. Do not apply near a pacemaker.

5.63 Prolapsed intervertebral disc

position of electrodes: A

TENS random (100 μsec, frequency 200 Hz) - **prog. 1617.**
Time of application 20 minutes.
Intensity at or above threshold sensitivity.
Place one electrode on the spine at the point of origin of the stimulated nerve, the other as distal as possible in the area of radiation. Another possibility is the application of this current by a point-contact electrode to the reflection zones ("triggers") in the interdigital areas (between I. and II. finger at stimulation in the L5 segment and between IV. and V. finger at stimulation in the S1 segment).

5.64 Raynaud's disease

position of electrodes: A

TENS constant frequency (150 μs, frequency 125 Hz) - **prog. 5028.**
Time of application 30 minutes.
Intensity above threshold sensitivity.
In case of affection of lower limbs use paravertebral position of two electrodes in the height L4 - S1, for upper limbs use paravertebral position C6 - Th1. This segmental treatment shall be followed by local treatment where either place the affected area (usually fingers) between both electrodes or place one electrode on the affected area on the spine and the other one split into two (to be placed on each limb).

5.65 Raynaud's disease

position of electrodes: K

Isoplanar vector field (carrier frequency 4 kHz, AMF = 100 Hz, spectrum = 0 Hz, step change 1/1) - **prog. 2011.**
Time of application 10 minutes.
Intensity above threshold sensitivity. Do not change the intensity during application.
Vacuum electrodes are preferable. Spatial intersection of circuits so that the area being cured is in the current path.
Circuit A: one electrode homolaterally above the medial end of the clavicle, the other homolaterally, to the paravertebral fornix on the Th1 level.
Circuit B: one electrode homolaterally below the lateral end of the clavicle, the other contralaterally, to the paravertebral fornix on the C5 level.

5.66 Raynaud's disease, syndrome

position of electrodes: A

Träbert current, tetrapolar application - **prog. 0002**
Time of application 15 minutes, both A and B circuits.
Intensity above threshold sensitivity (feeling of burn, vibrations).
For treatment of upper limbs place both electrodes of the A circuit paravertebrally C_5-Th_1, electrodes of the B circuit on m. levator scapulae and on the most lateral part of spina scapulae.
For treatment of lower limbs place electrodes of the A circuit paravertebrally L_3-S_1, electrodes of the B circuit on the highest part of crista iliaca and on the lateral edge of gluteal muscles.

5.67 Raynaud's disease, syndrome

position of electrodes: A

Träbert current - **prog. 0002.**
Time of application 15 min
Intensity above threshold sensitivity.
Two large electrodes on the spine, for upper limbs on C_6-Th_1, for lower limbs Th_{3-6}, for lower limbs on Th_{12}-L_3 and L_4-S_2. This segmental treatment shall be followed by local treatment where the affected area is located between the electrodes.
An alternative to the local therapy is placing of the anode above vertebrae, the split cathode bilaterally acral.

5.68 Reinforcement of phasic muscles

position of electrodes: V

Kotz currents (carrier frequency 2,5 kHz, pulse frequency 100 Hz, pulse/pause 1:1, surge/pause 6/6) - **prog. 0724.**
Time of application 5 minutes.
Intensity above threshold motor level.
Electrodes are placed proximally and distally on the belly of the muscle that shall be trained. This training causes fast, explosive muscle contraction. Apply 3 x per week; combining with physiotherapy (exercise) is suitable.

5.69 Reinforcement of tonic muscles

position of electrodes: V

Kotz currents (carrier frequency 2,5 kHz, pulse frequency 50 Hz, pulse/pause 1:1, surge/pause 4/30) - **prog. 0713.**
Time of application 10 minutes.
Intensity above threshold motor level.

Electrodes are placed proximally and distally on the belly of the muscle that shall be trained. This training causes growth of the muscular tissue. Apply 3 x per week; combining with physiotherapy is suitable.

5.70 Spondylitis ankylopoetica - M. Bechterevi

position of electrodes: V

Träbert current - **prog. 0002**
Time of application 15 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
Place the anode above and the cathode on the area being cured.
Träbert current is indicated because of the instant strong analgesic effect, especially for osteochondrosis.

5.71 Sudeck's dystrophy (algodystrophic syndrome)

position of electrodes: S, A

TENS constant frequency, tetrapolar application (imp. 50 μsec, frequency 71 Hz) - **prog. 1426.**
Time of application 12 min, circuit A+B.
Intensity above threshold sensitivity (feeling of burn, vibrations).
Both electrodes of the A circuit are placed paravertebrally, homolaterally in the C6-Th1 area for upper limbs (segmental application) and in the L3-S1 area for lower limbs.
In case of affection of upper limbs place the electrodes of the B circuit on m.levator scapulae heterolaterally and on the most lateral part of spina scapulae (homolaterally), in case of affection of lower limbs place the electrodes on the highest point of crista iliaca and on the lateral part of gluteal muscles.

5.72 Sudeck's dystrophy (algodystrophic syndrome)

position of electrodes: K

Manually rotated dipole (carrier frequency 10 kHz, AMF = 100 Hz, spectrum = 0 Hz) - **prog. 2311 – 2316.**
Time of application 12 minutes.
Intensity above threshold sensitivity. During therapy it is suitable to keep the intensity on this level. By setting a suitable group of 2311 – 2316 target the dipole to the patient's maximum perception.
In case of affection of upper limbs place the electrodes on m. levator scapulae and the most lateral part of spina scapulae, in case of affection of lower limbs place the electrodes on the highest point of crista iliaca and the lateral part of gluteal muscles.
Application of electrotherapy directly in the area of porosis is absolutely contraindicated!!!

5.73 Tendovaginitis

position of electrodes: V, A

2-pole interference (carrier frequency 4 kHz, AMF 60 Hz, spectrum 40 Hz, continuous change 3/3/3) - **prog. 0944.**
Time of application 10 - 17 minutes, step 1 minute.
Intensity at threshold sensitivity, in most acute cases there must not occur contractions.
Place one electrode on the belly of the muscle, the other on the affected tendon.

5.74 Tendovaginitis (subacute)

position of electrodes: V, A

2-pole interference (carrier frequency 4 kHz, AMF 0 Hz, spectrum 100 Hz, continuous change 3/3/3) - **prog. 0942.**
Time of application 10 - 17 minutes, step 1 minute.
Intensity at threshold sensitivity.
One electrode on the belly of the muscle, the other on the tendon, preferably on the peritenon.

5.75 Tension cephalea (occipital neuralgia, unilateral)

position of electrodes: V

TENS burst (100 μsec, frequency 100 Hz, burst frequency 5 Hz) - **prog. 1832.**
Time of application 15 minutes.
Intensity above threshold sensitivity, up to the highest tolerable level.
Place two electrodes on the most pressure-sensitive points on m.trapezius.

5.76 Torn muscle

position of electrodes: V

2-pole interference (carrier frequency 10 kHz, AMF 60 Hz, spectrum 40 Hz, continuous change 3/3/3) - **prog. 2744.**
Time of application 7 minutes.
Intensity at threshold motor level, at the acute stage at threshold sensitivity. The electrodes are on the muscle wall, vertically to the direction of the muscle fibres.

5.77 Trigger points, deep

position of electrodes: T

2-pole interference (carrier frequency 4 kHz, AMF 100 Hz, spectrum 50 Hz, step change 3/3) – **prog. 0926.**
Time of application 3 minutes (per a trigger point).
Intensity at threshold motor level.
By using the point-contact electrode you can localize a trigger or a hyperalgesic area (the patient identifies "his/her" typical pain). The other electrode is placed contra-laterally. For the therapy itself also small plate electrodes can be used.

5.78 Trigger points, superficial

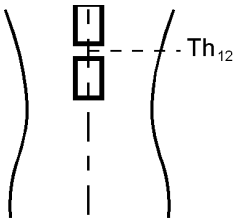
position of electrodes: T

Diadynamic DF - **prog. 0111.**
Time of application 2 minutes (per a trigger point).
Intensity at threshold motor level.
By using the point-contact electrode you can localize a trigger or a hyperalgesic area (the patient identifies "his/her" typical pain). The other electrode is placed contra-laterally. For the therapy itself also small plate electrodes can be used.

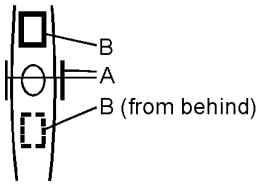
6 POSITION OF ELECTRODES

Position of electrodes A = atypical, must be found out at the appurtenant diagnosis

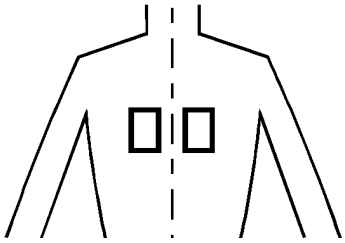
Position of electrodes EL = classic vertebral position according to Träbert



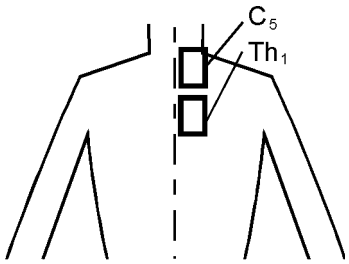
Position of electrodes K = crosswise around the affected area:



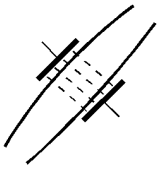
Position of electrodes P = paravertebral:



Position of electrodes S = segmental:



Position of electrodes T = transregional diagonal:



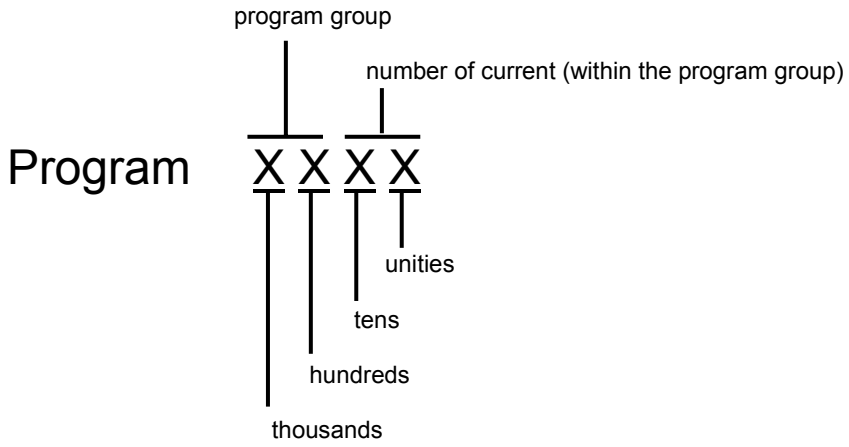
Position of electrodes V = side by side:

7 OVERVIEW OF ALL PROGRAMS

This overview contains all currents that can be used if the equipment is equipped with all needed circuits and complete application software. If the equipment is still not fully equipped, the codes of the appurtenant currents are not available.
The code of each current consists of a four-digit number – "Program". This number is displayed on the **PROGRAMME** display **(1)** and is entered on the equipment by the buttons **(13)**, **(14)**, **(15)** and **(16)**, located below this display. The first two digits (**thousands** and **hundreds**) are called **program group**, the third and the fourth digit (**tens** and **unities**) are called **number of current**.
The group characterizes the type of the current, the number of current specifies the parameters of the individual currents.
The symbol (+/-) stated at some groups of currents means that for this group of currents it is possible to set the intensity of both polarities.
For the currents which can be run only in one of the output modes there is stated which mode it is:

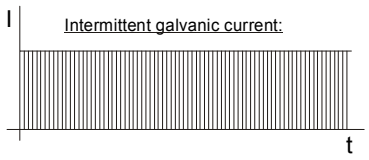
CC – current output (constant current),
CV – voltage output (constant voltage).

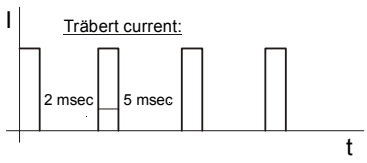
The groups without the above-mentioned can be operated in both modes. In case of use of the point-contact electrode or interconnection with the ultrasound we recommend using of the CV mode.
The stated maximum values of currents presuppose impedance of the patient 500 Ω and the stated maximum values can be set only if at the same time the stated maximum current through the patient is not exceeded.
In case of application of the currents marked with the symbol **(+/-)** – currents with the DC component – it is necessary to pay attention to the set intensity and time of application of the currents. Improperly chosen values may cause burning of the patient.
The maximum secure effective value of the current density on the electrodes is 2 mA/cm^2 (according to IEC 601-2-10) and can be exceeded with this equipment if the size of the used electrodes is smaller than 22 cm^2, i.e. for example point-contact electrode, an electrode smaller than 6 x 4 cm^2 etc. In such a case it is necessary to pay enhanced attention to the application of currents!

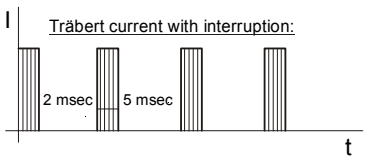


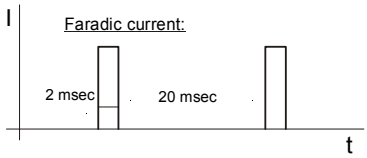
Groups 00: Galvanic current, iontophoresis, faradic currents, Träbert current (+/-)

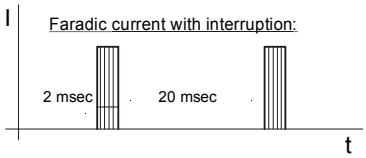
tens:	unities:	name and description of current, additional details	maximum
0:	**1:**	Galvanic current (it is necessary to use protective solutions)	65 mA
	2:	Träbert current, also called Ultra-Reiz, current 2-5; rectangular pulses 2 msec, spacing 5 msec	90 mA
	3:	Faradic rectangular rectangular pulses 2 msec, spacing 20 msec	140 mA
	4:	Faradic triangular, also called "Neofarad" triangular pulses with slow rise; 2 msec pulse, spacing 20 msec	140 mA
	5:	Träbert current, also called Ultra-Reiz, current 2-5; rectangular pulses 2 msec, spacing 5 msec automatic change of polarity of electrodes in the middle of the set time of therapy	90 mA
1:	**1:**	Iontophoresis, galvanic intermittent current frequency of interruption 8 kHz duty factor 95 %	65 mA
	2:	Träbert current, also called Ultra-Reiz, current 2-5; rectangular pulses 2 msec, spacing 5 msec; interrupted with the frequency 8 kHz, duty factor 95 %	90 mA
	3:	Faradic rectangular rectangular pulses 2 msec, spacing 20 msec; interrupted with the frequency 8 kHz, duty factor 95 %	140 mA
	4:	Faradic triangular, also called "Neofarad" triangular pulses with slow rise; 2 msec pulse, spacing 20 msec; interrupted with the frequency 8 kHz, duty factor 95 %	140 mA
	5:	Träbert current, also called Ultra-Reiz, current 2-5; rectangular pulses 2 msec, spacing 5 msec automatic change of polarity of electrodes in the middle of the set time of therapy; interrupted with the frequency 8 kHz, duty factor 95 %	90 mA

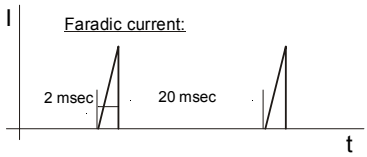


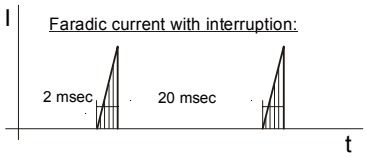












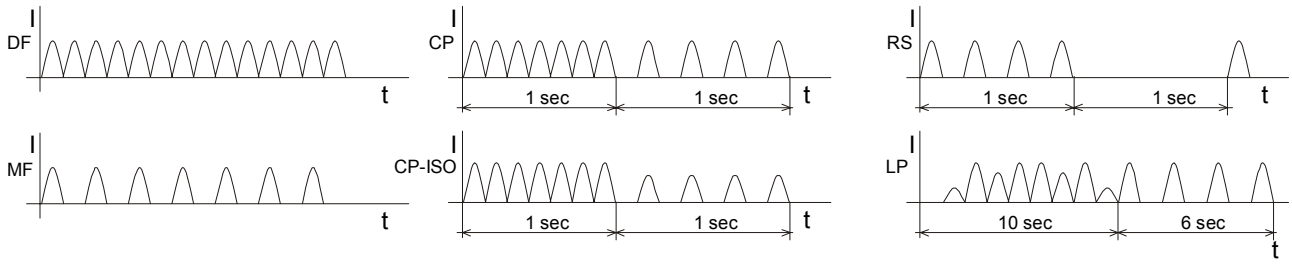
Group 01: Diadynamic currents (+/-)

tens:	name and description of the current, additional specification	maximum
1:	DF – sinusoidal pulses 10 msec without spacing, frequency 100 Hz (two-way-rectified mains frequency 50 Hz)	70 mA
2:	MF – sinusoidal pulses 10 msec with spacing 10 msec, frequency 50 Hz (one-way-rectified mains frequency 50 Hz)	100 mA
3:	CP - 1 sec pulses of the type DF, 1 sec pulses of the type MF	80 mA
4:	LP – 10 sec combination of pulses of the types MF and DF, 6 sec pulses of the type MF	80 mA
5:	RS – 1 sec sinusoidal pulses MF, 1 sec space	100 mA
6:	CP-ISO - 1 sec pulses of the type DF, 1 sec pulses of the type MF with the amplitude 15 % lower than the DF pulses	80 mA

unities:	specification
1:	without base (base is a permanent DC component which the pulses are added to)
2:	base 0,5 % of the set amplitude of the current
3:	base 1 % of the set amplitude of the current
4:	base 2 % of the set amplitude of the current
5:	base 5 % of the set amplitude of the current
6:	base 10 % of the set amplitude of the current
7:	base 20 % of the set amplitude of the current

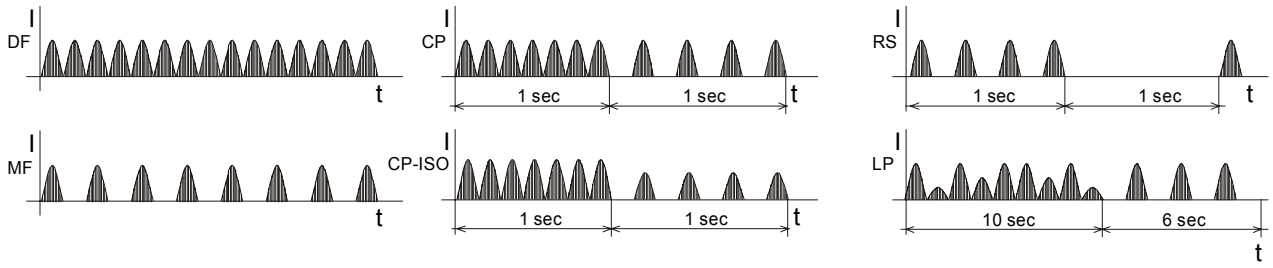
Courses of **group 01**:

Diadynamic currents:



Courses of **group 31** (identical with group 01, but the signal is interrupted by 5 μs pulses with the frequency 8 kHz):

Diadynamic currents with interruption:



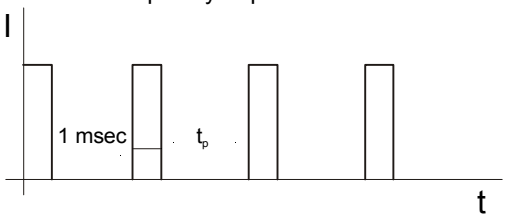
Note:

groups 32, 33 have the same combinations of currents as groups 01 and 31, but they are derived from the mains frequency 60 Hz

Group 02: Rectangular pulses 1 msec of one polarity (with the DC component), (+/-)

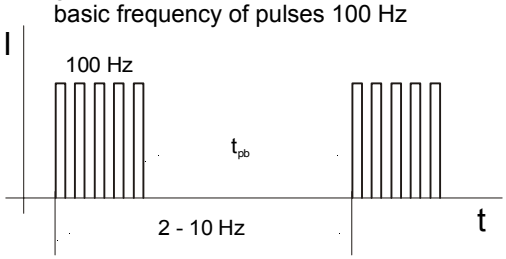
maximum amplitude 140 mA, for the frequencies 143 Hz and 200 Hz only 100 mA

tens:
1: fixed frequency of pulses



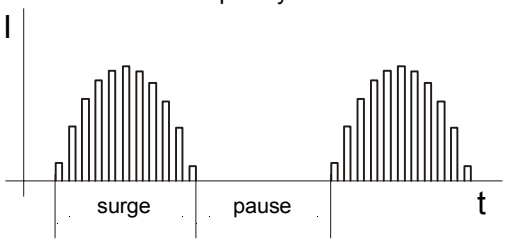
unities: frequency of pulses (time between pulses – t_p)
1: 50 Hz (19 msec)
2: 100 Hz (9 msec) {so called Leduc's current}
3: 143 Hz (6 msec)
4: 200 Hz (4 msec)
5: 1 Hz (999 msec)
6: 2 Hz (499 msec)
7: 5 Hz (199 msec)
8: 10 Hz (99 msec)
9: 20 Hz (49 msec)

tens:
2: group of 5 pulses (burst), basic frequency of pulses 100 Hz



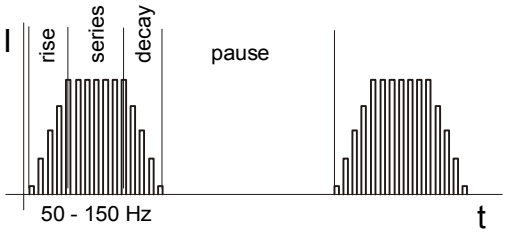
unities: frequency of bursts (time between bursts – t_{pb})
1: 2,2 Hz (409 msec)
2: 5 Hz (159 msec)
3: 6,7 Hz (109 msec)
4: 10 Hz (59 msec)

tens: surges modulated by half-period of sine
3: of the basic frequency 50 Hz
4: of the basic frequency 100 Hz
5: of the basic frequency 143 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 1 / 6
3: 3 / 1
4: 3 / 3
5: 3 / 6
6: 3 / 10
7: 5 / 3
8: 5 / 5
9: 5 / 10

tens: surges
6: of the basic frequency 50 Hz
7: of the basic frequency 100 Hz
8: of the basic frequency 143 Hz

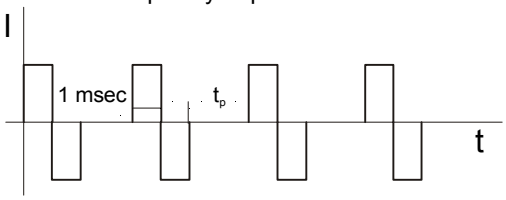


unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 03: Rectangular pulses 1 msec, biphasic symmetric (+/-)

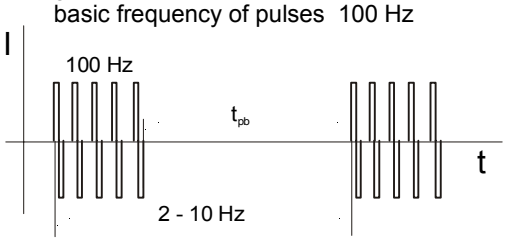
maximum amplitude 140 mA, for frequencies 143 Hz and 200 Hz only 100 mA

tens:
1: fixed frequency of pulses



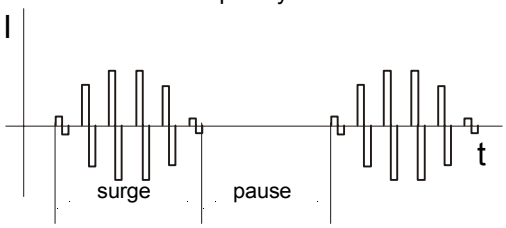
unities: frequency of pulses (time between pulses – t_p)
1: 50 Hz (18 msec)
2: 100 Hz (8 msec)
3: 143 Hz (5 msec)
4: 200 Hz (3 msec)
5: 1 Hz (998 msec)
6: 2 Hz (498 msec)
7: 5 Hz (198 msec)
8: 10 Hz (98 msec)
9: 20 Hz (48 msec)

tens:
2: group of 5 pulses (burst),
basic frequency of pulses 100 Hz



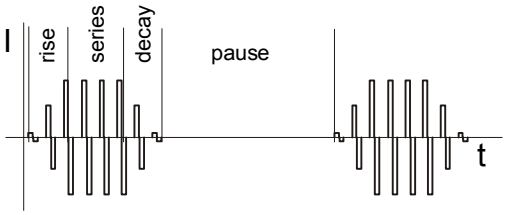
unities: frequency of bursts (time between bursts – t_{pb})
1: 2,2 Hz (408 msec)
2: 5 Hz (158 msec)
3: 6,7 Hz (108 msec)
4: 10 Hz (58 msec)

tens: surges modulated by half-period of sine
3: of the basic frequency 50 Hz
4: of the basic frequency 100 Hz
5: of the basic frequency 143 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 1 / 6
3: 3 / 1
4: 3 / 3
5: 3 / 6
6: 3 / 10
7: 5 / 3
8: 5 / 5
9: 5 / 10

tens: surges
6: of the basic frequency 50 Hz
7: of the basic frequency 100 Hz
8: of the basic frequency 143 Hz

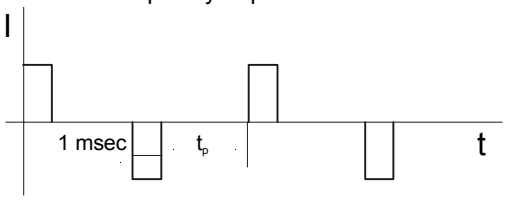


unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 04: Rectangular pulses 1 msec, biphasic alternating

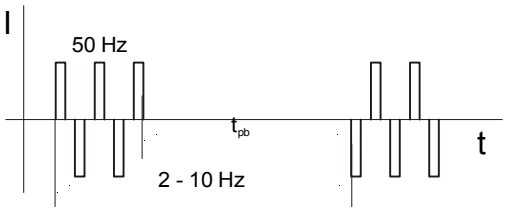
maximum amplitude 140 mA, for frequencies 71 Hz and 100 Hz only 100 mA

tens:
1: fixed frequency of pulses



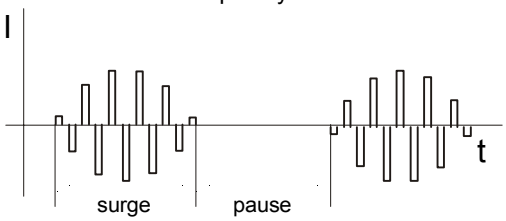
unities: frequency of pulses (time between pulses – t_p)
1: 25 Hz (19 msec)
2: 50 Hz (9 msec)
3: 71 Hz (6 msec)
4: 100 Hz (4 msec)
5: 0,5 Hz (999 msec)
6: 1 Hz (499 msec)
7: 2,5 Hz (199 msec)
8: 5 Hz (99 msec)
9: 10 Hz (49 msec)

tens:
2: group of 5 pulses (burst),
basic frequency of pulses 50 Hz



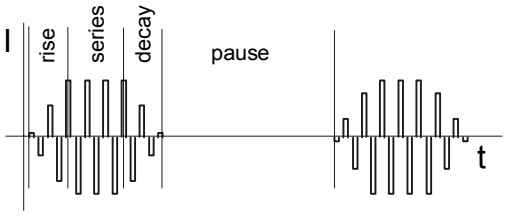
unities: frequency of bursts (time between bursts – t_{pb})
1: 2,2 Hz (409 msec)
2: 5 Hz (159 msec)
3: 6,7 Hz (109 msec)
4: 10 Hz (59 msec)

tens: surges modulated by half-period of sine
3: of the basic frequency 25 Hz
4: of the basic frequency 50 Hz
5: of the basic frequency 71 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 1 / 6
3: 3 / 1
4: 3 / 3
5: 3 / 6
6: 3 / 10
7: 5 / 3
8: 5 / 5
9: 5 / 10

tens: surges
6: of the basic frequency 25 Hz
7: of the basic frequency 50 Hz
8: of the basic frequency 71 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 05: Measuring of I/t-curve (+/-) (CC)

I/t curve can be measured only on the A channel. Displays of the channel B serve for displaying of values of the other I/t curve measured on the other muscle (groups 052x, 054x), or pulses of different shape (groups 051x, 053x). At each generated pulse the equipment beeps – length of the beep approximately corresponds to the length of the pulse. After measuring of the I/t curve the equipment specifies the value of chronaxie and rheobasis and makes the required calculations of the accommodation coefficient or evaluation of the most suitable stimulation.

The I/t curve being measured can have up to 21 points, but it is not necessary to measure all of the stated points. The points the intensity of which is zero are not included in the calculations of chronaxie and rheobasis and in the evaluation.

The accommodation coefficient can be measured separately without measuring of the entire I/t curve – it is sufficient to measure only values for the pulses of the length 1 sec.

All the stated curves remain stored in the equipment's memory after measuring.

Note:

Before new measuring of I/t curve it is necessary to clear the previously measured I/t curve by pressing the **STOP B** button **(23)**; see **2.4.5.1 Description of the Equipment's Function at Measuring of I/t-curve**.

!ATTENTION!

At this measuring the equipment does not check the connection of the patient, so the pulses for the measuring are generated even if the patient is disconnected. Therefore pay enhanced attention during this measurement!

tens: 1: measuring of I/t curves with calculation of chronaxie, rheobasis and accommodation coefficient

unities: **1:** measuring of the I/t curve by rectangular pulses
2: measuring of the I/t curve by triangular pulses (with slow front edge)

tens: 2: measuring of I/t curves with calculation of chronaxie and rheobasis and evaluation of the most suitable stimulation

(i.e. by determination of the pulse length and amplitude most suitable for the stimulation)

unities: **1:** triangular pulses (healthy muscle)
2: triangular pulses (denervated muscle)

tens: 3: measuring of next I/t curves with calculation of chronaxie, rheobasis and accommodation coefficient

unities: **1:** measuring of the I/t curve by rectangular pulses
2: measuring of the I/t curve by triangular pulses (with slow front edge)

tens: 4: measuring of next I/t curves with calculation of chronaxie and rheobasis and evaluation of the most suitable stimulation

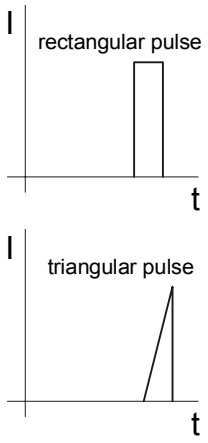
(i.e. by determination of the pulse length and amplitude most suitable for the stimulation)

unities: **1:** triangular pulses (healthy muscle)
2: triangular pulses (denervated muscle)

Pulses generated at measuring of I/t curve:

Table of pulse lengths

point	pulse	pause	maximum
Pt 1	100 μs	1 sec	140 mA
Pt 2	200 μs	1 sec	140 mA
Pt 3	300 μs	1 sec	140 mA
Pt 4	500 μs	1 sec	140 mA
Pt 5	700 μs	1 sec	140 mA
Pt 6	1 msec	1 sec	140 mA
Pt 7	2 msec	1 sec	140 mA
Pt 8	3 msec	1 sec	140 mA
Pt 9	5 msec	1 sec	140 mA
Pt 10	7 msec	1 sec	140 mA
Pt 11	10 msec	1,5 sec	140 mA
Pt 12	20 msec	1,5 sec	110 mA
Pt 13	30 msec	1,5 sec	90 mA
Pt 14	50 msec	1,5 sec	80 mA
Pt 15	70 msec	1,5 sec	70 mA
Pt 16	100 msec	2 sec	70 mA
Pt 17	200 msec	2 sec	65 mA
Pt 18	300 msec	2 sec	65 mA
Pt 19	500 msec	2,5 sec	65 mA
Pt 20	700 msec	2,5 sec	65 mA



Pt 21	1 sec	3 sec	65 mA

For recording of the measured I/t curve you can use the graph in the Appendix at the end of this document.

Group 06: Stimulation pulses (+/-)

intended for stimulation according to the evaluation from the measured I/t – curve (programs 052x and 054x)

pulse shape	tens	unities	pulse length	pause	max. current
rectangular	**1**	**0**	100 μs	1 sec	140 mA
rectangular	**1**	**1**	200 μs	1 sec	140 mA
rectangular	**1**	**2**	300 μs	1 sec	140 mA
rectangular	**1**	**3**	500 μs	1 sec	140 mA
rectangular	**1**	**4**	700 μs	1 sec	140 mA
rectangular	**1**	**5**	1 msec	1 sec	140 mA
rectangular	**1**	**6**	2 msec	1 sec	140 mA
rectangular	**1**	**7**	3 msec	1 sec	140 mA
rectangular	**1**	**8**	5 msec	1 sec	140 mA
rectangular	**1**	**9**	7 msec	1 sec	140 mA
rectangular	**2**	**0**	10 msec	1,5 sec	140 mA
rectangular	**2**	**1**	20 msec	1,5 sec	110 mA
rectangular	**2**	**2**	30 msec	1,5 sec	90 mA
rectangular	**2**	**3**	50 msec	1,5 sec	80 mA
rectangular	**2**	**4**	70 msec	1,5 sec	70 mA
rectangular	**2**	**5**	100 msec	2 sec	70 mA
rectangular	**2**	**6**	200 msec	2 sec	65 mA
rectangular	**2**	**7**	300 msec	2 sec	65 mA
rectangular	**2**	**8**	500 msec	2,5 sec	65 mA
rectangular	**2**	**9**	700 msec	2,5 sec	65 mA
rectangular	**3**	**0**	1 sec	3 sec	65 mA
triangular	**4**	**0**	100 μs	1 sec	140 mA
triangular	**4**	**1**	200 μs	1 sec	140 mA
triangular	**4**	**2**	300 μs	1 sec	140 mA
triangular	**4**	**3**	500 μs	1 sec	140 mA
triangular	**4**	**4**	700 μs	1 sec	140 mA
triangular	**4**	**5**	1 msec	1 sec	140 mA
triangular	**4**	**6**	2 msec	1 sec	140 mA
triangular	**4**	**7**	3 msec	1 sec	140 mA
triangular	**4**	**8**	5 msec	1 sec	140 mA
triangular	**4**	**9**	7 msec	1 sec	140 mA
triangular	**5**	**0**	10 msec	1,5 sec	140 mA
triangular	**5**	**1**	20 msec	1,5 sec	140 mA
triangular	**5**	**2**	30 msec	1,5 sec	110 mA
triangular	**5**	**3**	50 msec	1,5 sec	90 mA
triangular	**5**	**4**	70 msec	1,5 sec	80 mA
triangular	**5**	**5**	100 msec	2 sec	70 mA
triangular	**5**	**6**	200 msec	2 sec	70 mA
triangular	**5**	**7**	300 msec	2 sec	65 mA
triangular	**5**	**8**	500 msec	2,5 sec	65 mA
triangular	**5**	**9**	700 msec	2,5 sec	65 mA
triangular	**6**	**0**	1 sec	3 sec	65 mA

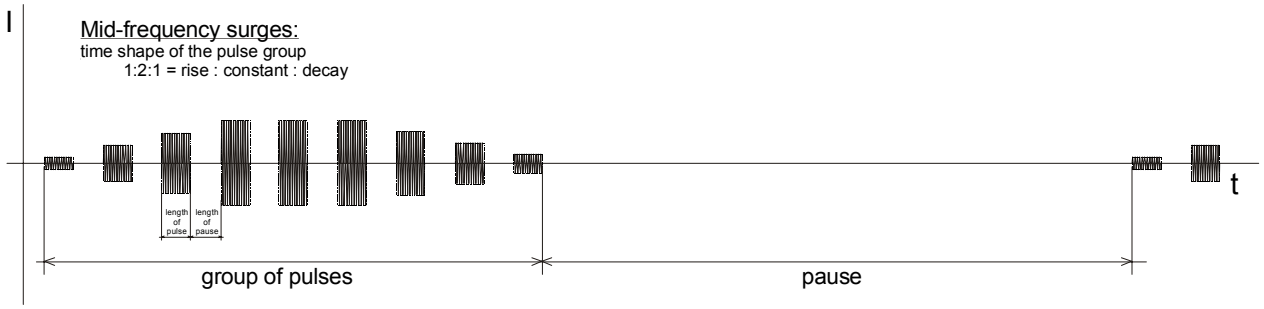
Group 07: Bipolar surges (so called Russian stimulation, Kotz currents)

carrier frequency 2,5 kHz modulated by rectangular pulse
maximum current 140 mA

Note:
group 28 – the same courses, but the carrier frequency is 4 kHz
group 29 – the same courses, but the carrier frequency is 10 kHz

tens: frequency of pulses; pulse length:pause length ratio
1: 50 Hz; 1 : 1
2: 100 Hz; 1 : 1
3: 50 Hz; 1 : 2
4: 100 Hz; 1 : 2
5: 50 Hz; 1 : 4
6: 100 Hz; 1 : 4
7: 50 Hz; 1 : 6
8: 100 Hz; 1 : 6

unities: group of pulses (surge) / pause
1: 4 sec / 4 sec
2: 4 sec / 12 sec
3: 4 sec / 30 sec
4: 6 sec / 6 sec
5: 6 sec / 12 sec
6: 6 sec / 30 sec
7: 12 sec / 12 sec
8: 12 sec / 30 sec



Group 08: 4-pole interference 4 kHz

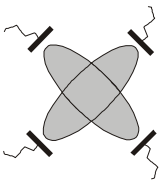
basic carrier frequency 4 kHz
channel A – constant frequency, channel B – modulated within the range 3,8 kHz – 4 kHz
maximum current 100 mA

Note:
group 26 – the same courses of modulation, but the carrier frequency is 10 kHz

interval of retuning (sec):
tens:
1: frequency jumping 1/1
2: frequency jumping 3/3
3: frequency jumping 6/6
4: continuous change 3/3/3
5: continuous change 5/1/5
6: continuous change 6/0/6
7: random 1/1
8: random 3/3
9: random 6/6

modulation (Hz)
unities:
1: 1-10 i.e. AMF = 1 Hz; Spectrum = 9 Hz
2: 1-100 i.e. AMF = 1 Hz; Spectrum = 99 Hz
3: 30-60 i.e. AMF = 30 Hz; Spectrum = 30 Hz
4: 60-100 i.e. AMF = 60 Hz; Spectrum = 40 Hz
5: 90-150 i.e. AMF = 90 Hz; Spectrum = 60 Hz
6: 100-150 i.e. AMF = 100 Hz; Spectrum = 50 Hz
7: 100-200 i.e. AMF = 100 Hz; Spectrum = 100 Hz
8: 120-200 i.e. AMF = 120 Hz; Spectrum = 80 Hz
9: 150-200 i.e. AMF = 150 Hz; Spectrum = 50 Hz

Classic 4-pole interference:

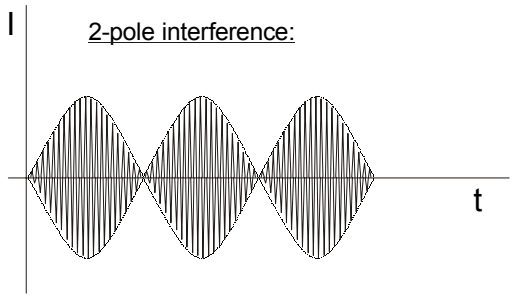


Group 09: Amplitude-modulated current (2-pole interference)

basic carrier frequency 4 kHz
maximum current 140 mA

Note:
group 27 – the same courses of modulation, but the carrier frequency is 10 kHz

interval of retuning (sec):			modulation (Hz)	
tens:	**1:** frequency jumping 1/1	**unities:**	**1:** 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz
	2: frequency jumping 3/3		**2:** 4-100	i.e. AMF = 4 Hz; Spectrum = 96 Hz
	3: frequency jumping 6/6		**3:** 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz
	4: continuous change 3/3/3		**4:** 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz
	5: continuous change 5/1/5		**5:** 90-140	i.e. AMF = 90 Hz; Spectrum = 50 Hz
	6: continuous change 6/0/6		**6:** 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz
	7: random 1/1		**7:** 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz
	8: random 3/3		**8:** 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz
	9: random 6/6		**9:** 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz



Group 10: TENS pulses 10 μs, symmetric

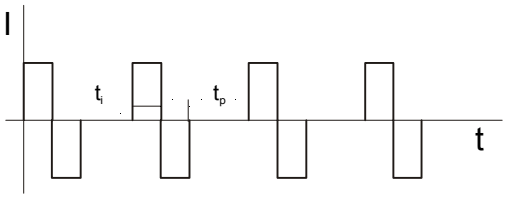
maximum amplitude 140 mA

Note:
the courses of pulses of **group 40** are the same, but the basic pulse length is different – 20 μs
the courses of pulses of **group 43** are the same, but the basic pulse length is different – 30 μs

tens: **1:** random frequency oscillating around the mean value ± 30 %

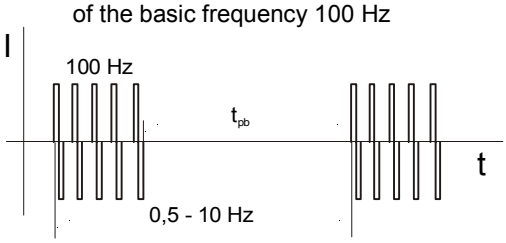
mean value of frequency (Hz)
(time between pulses - t_p)
unities: **0:** 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

tens: 2: constant frequency



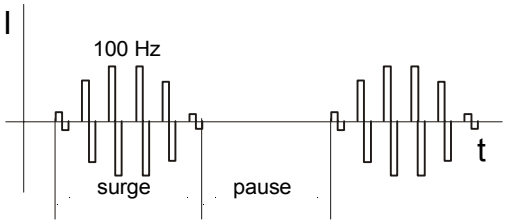
frequency (Hz) (time between pulses - t_p)
unities: **0:** 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



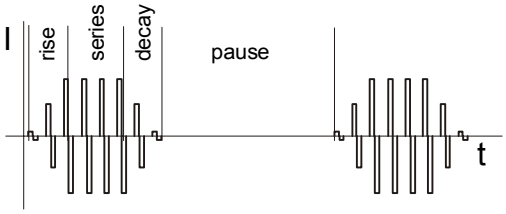
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 50 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 11: TENS pulses 10 μs, alternating

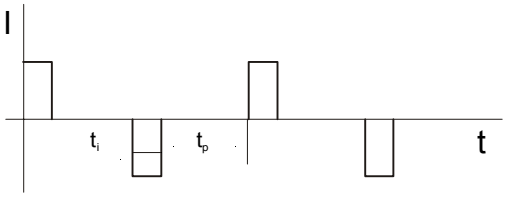
maximum amplitude 140 mA

Note:
the courses of pulses of **group 41** are the same, but the basic pulse length is different – 20 μs
the courses of pulses of **group 44** are the same, but the basic pulse length is different – 30 μs

tens: 1: random frequency oscillating around the mean value ± 30 %

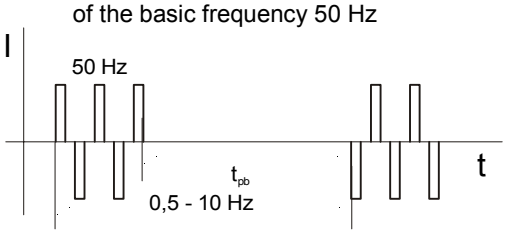
mean value of frequency (Hz)
(time between pulses - t_p)
unities: **0:** 0,5 (1 sec) **5:** 50 (10 msec)
1: 1 (500 msec) **6:** 71 (7 msec)
2: 2,5(200 msec) **7:** 100 (5 msec)
3: 5 (100 msec) **8:** 125 (4 msec)
4: 25 (20 msec) **9:** 500 (1 msec)

tens: 2: constant frequency



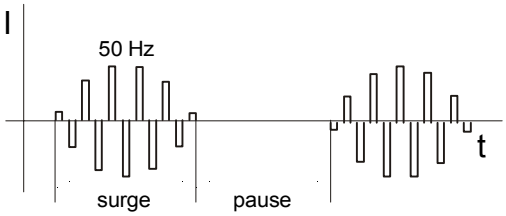
frequency (Hz) (time between pulses - t_p)
unities: **0:** 0,5 (1 sec) **5:** 50 (10 msec)
1: 1 (500 msec) **6:** 71 (7 msec)
2: 2,5(200 msec) **7:** 100 (5 msec)
3: 5 (100 msec) **8:** 125 (4 msec)
4: 25 (20 msec) **9:** 500 (1 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 50 Hz



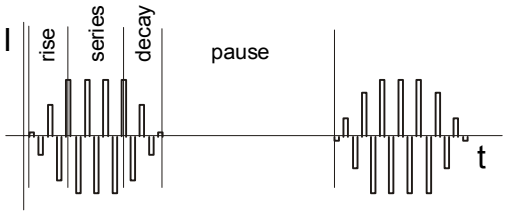
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 50 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 25 Hz
6: of the basic frequency 50 Hz
7: of the basic frequency 71 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 12: TENS pulses 10 μsec, asymmetric

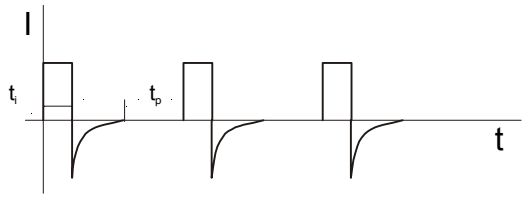
maximum amplitude 140 mA

Note:
the courses of pulses of **group 42** are the same, but the basic pulse length is different – 20 μs
the courses of pulses of **group 45** are the same, but the basic pulse length is different – 30 μs

tens: 1: random frequency oscillating around the mean value ± 30 %

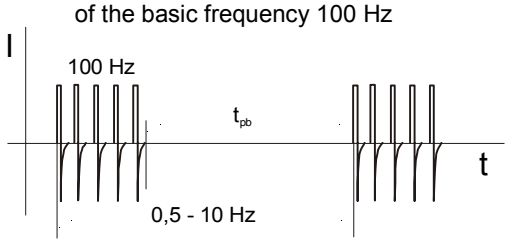
mean value of frequency (Hz)
(time between pulses - t_p)
unities: **0:** 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

tens: 2: constant frequency



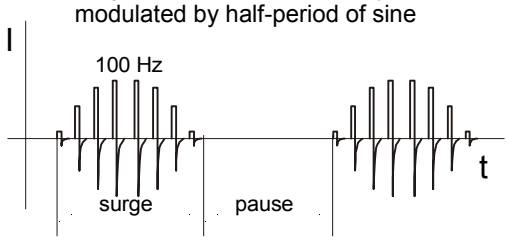
frequency (Hz) (time between pulses - t_p)
unities: **0:** 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



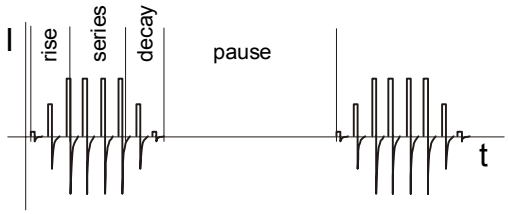
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 50 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 13: TENS pulses 50 μs, symmetric (+/-)

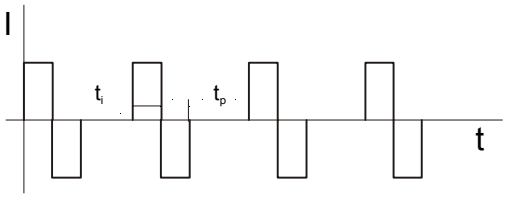
maximum amplitude 140 mA

tens:1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz)
(period – t_i + tp)

unities:
0: 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

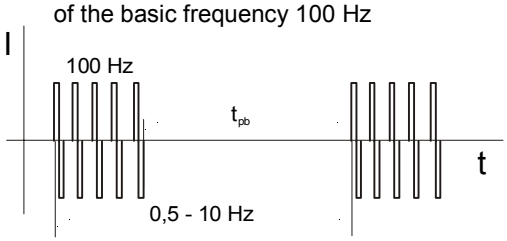
tens:2: constant frequency



frequency (Hz) (time between pulses - t_p)

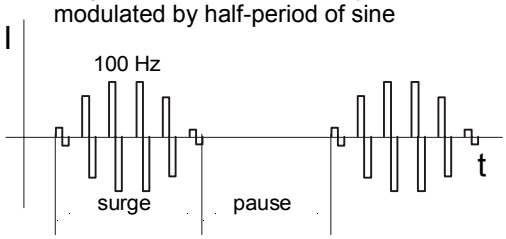
unities:
0: 1 (1 sec) **5:** 100 (10 msec)
1: 2 (500 msec) **6:** 143 (7 msec)
2: 5 (200 msec) **7:** 200 (5 msec)
3: 10 (100 msec) **8:** 250 (4 msec)
4: 50 (20 msec) **9:** 1000 (1 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



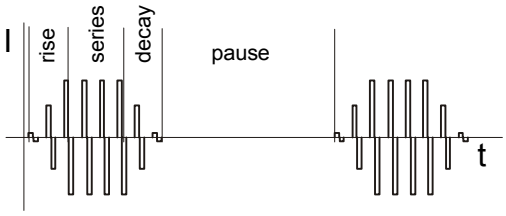
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 80 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 14: TENS pulzy 50 μs alternating

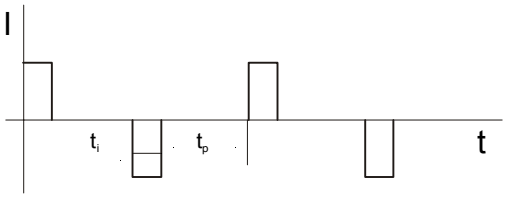
maximum amplitude 140 mA

tens: 1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz) (time between pulses - t_p)

unities:
0: 0,5 (1 s) **5:** 50 (10 msec)
1: 1 (500 msec) **6:** 71 (7 msec)
2: 2,5(200 msec) **7:** 100 (5 msec)
3: 5 (100 msec) **8:** 125 (4 msec)
4: 25 (20 msec) **9:** 500 (1 msec)

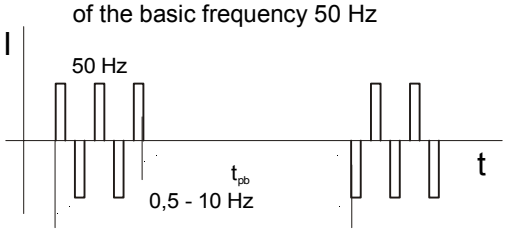
tens: 2: constant frequency



frequency (Hz) (time between pulses - t_p)

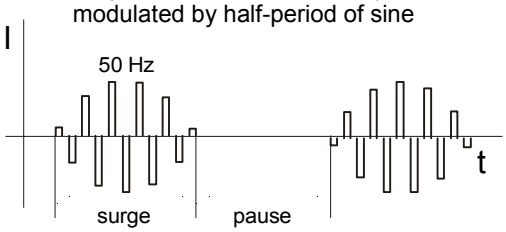
unities:
0: 0,5 (1 s) **5:** 50 (10 msec)
1: 1 (500 msec) **6:** 71 (7 msec)
2: 2,5(200 msec) **7:** 100 (5 msec)
3: 5 (100 msec) **8:** 125 (4 msec)
4: 25 (20 msec) **9:** 500 (1 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 50 Hz



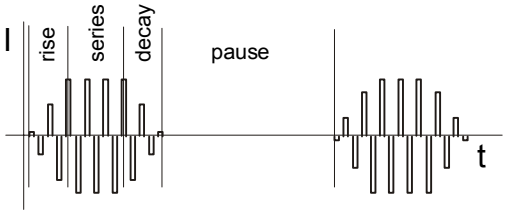
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 50 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 40 Hz
6: of the basic frequency 50 Hz
7: of the basic frequency 71 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 15: TENS pulzy 50 μs asymmetric (+/-)

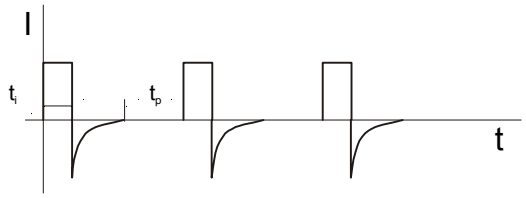
maximum amplitude 140 mA

tens: 1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz)
(time between pulses - t_p)

unities:
0: 1 (1 s) **5:** 100 (9,8 msec)
1: 2 (500 msec) **6:** 143 (6,8 msec)
2: 5 (200 msec) **7:** 200 (4,8 msec)
3: 10 (100 msec) **8:** 250 (3,8 msec)
4: 50 (20 msec) **9:** 1000 (0,8 msec)

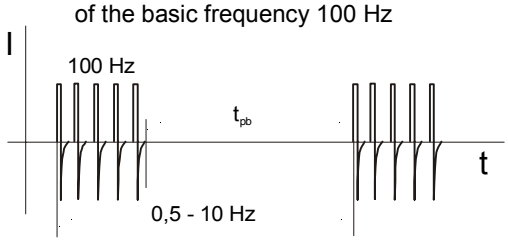
tens: 2: constant frequency



frequency (Hz) (time between pulses - t_p)

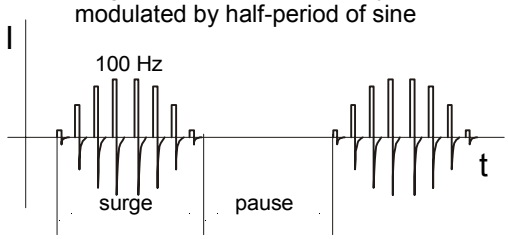
unities:
0: 1 (1 s) **5:** 100 (9,8 msec)
1: 2 (500 msec) **6:** 143 (6,8 msec)
2: 5 (200 msec) **7:** 200 (4,8 msec)
3: 10 (100 msec) **8:** 250 (3,8 msec)
4: 50 (20 msec) **9:** 1000 (0,8 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



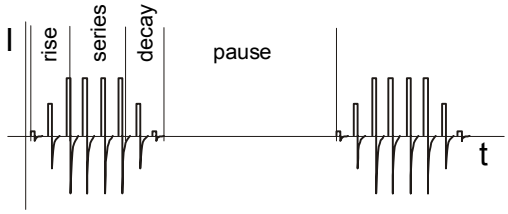
unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)
0: 1 / 1 **5:** 6 / 3
1: 1 / 3 **6:** 6 / 6
2: 3 / 1 **7:** 6 / 10
3: 3 / 3 **8:** 10 / 10
4: 3 / 6 **9:** 10 / 20

tens: surges
5: of the basic frequency 80 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 16: TENS pulses 100 μs, symmetric (+/-)

maximum amplitude 140 mA; for the frequency 1000 Hz the maximum is only 100 mA

Note (maximum amplitudes of currents are written at each group):
the courses of pulses of **group 46** are the same, but the basic pulse length is different – 70 μsec
the courses of pulses of **group 49** are the same, but the basic pulse length is different – 150 μsec
the courses of pulses of **group 52** are the same, but the basic pulse length is different – 200 μsec
the courses of pulses of **group 55** are the same, but the basic pulse length is different – 300 μsec

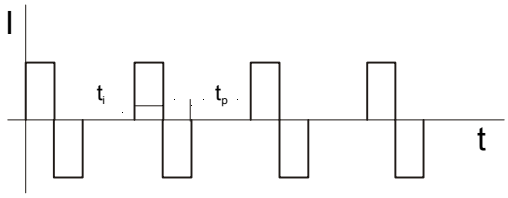
tens: 1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz)
(time between pulses - t_p)

unities:

0: 1 (1 s)	**5:** 100 (9,8 msec)
1: 2 (500 msec)	**6:** 143 (6,8 msec)
2: 5 (200 msec)	**7:** 200 (4,8 msec)
3: 10 (100 msec)	**8:** 250 (3,8 msec)
4: 50 (20 msec)	**9:** 1000 (0,8 msec)

tens: 2: constant frequency

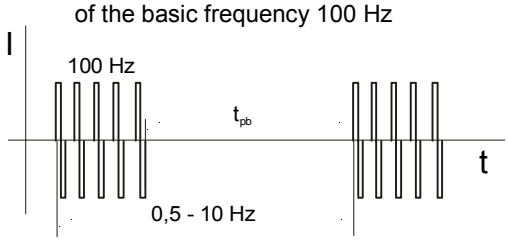


frequency (Hz) (time between pulses - t_p)

unities:

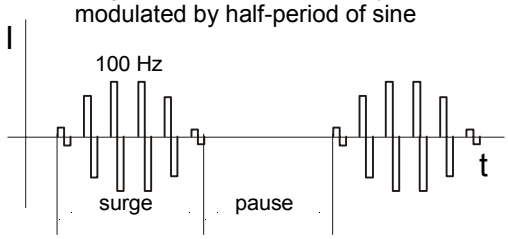
0: 1 (1 s)	**5:** 100 (9,8 msec)
1: 2 (500 msec)	**6:** 143 (6,8 msec)
2: 5 (200 msec)	**7:** 200 (4,8 msec)
3: 10 (100 msec)	**8:** 250 (3,8 msec)
4: 50 (20 msec)	**9:** 1000 (0,8 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

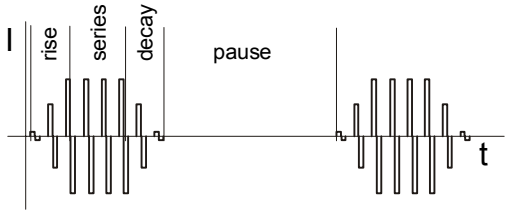
tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)

0: 1 / 1	**5:** 6 / 3
1: 1 / 3	**6:** 6 / 6
2: 3 / 1	**7:** 6 / 10
3: 3 / 3	**8:** 10 / 10
4: 3 / 6	**9:** 10 / 20

tens: surges
5: of the basic frequency 50 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 17: TENS pulses 100 μs, alternating

maximum amplitude 140 mA; for the frequency 500 Hz the maximum is only 100 mA

Note (maximum amplitudes of currents are written at each group):
the courses of pulses of **group 47** are the same, but the basic pulse length is different – 70 μs
the courses of pulses of **group 50** are the same, but the basic pulse length is different – 150 μs
the courses of pulses of **group 53** are the same, but the basic pulse length is different – 200 μs
the courses of pulses of **group 56** are the same, but the basic pulse length is different – 300 μs

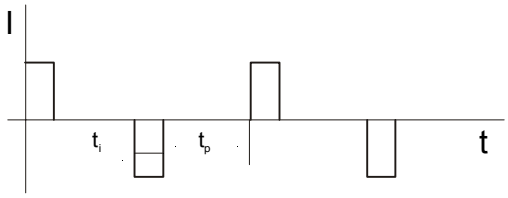
tens: 1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz) (time between pulses - t_p)

unities:

0: 0,5 (1 s)	**5:** 50 (9,9 msec)
1: 1 (500 msec)	**6:** 71 (6,9 msec)
2: 2,5 (200 msec)	**7:** 100 (4,9 msec)
3: 5 (100 msec)	**8:** 125 (3,9 msec)
4: 25 (20 msec)	**9:** 500 (0,9 msec)

tens: 2: constant frequency

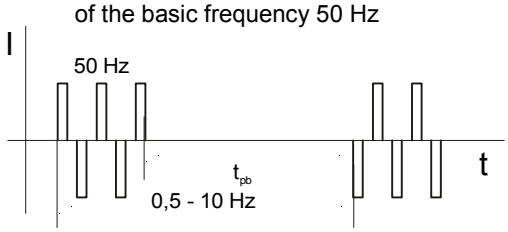


frequency (Hz) (time between pulses - t_p)

unities:

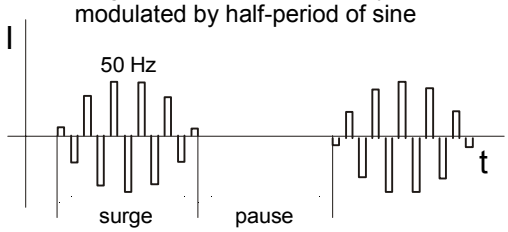
0: 0,5 (1 s)	**5:** 50 (9,9 msec)
1: 1 (500 msec)	**6:** 71 (6,9 msec)
2: 2,5 (200 msec)	**7:** 100 (4,9 msec)
3: 5 (100 msec)	**8:** 125 (3,9 msec)
4: 25 (20 msec)	**9:** 500 (0,9 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 50 Hz



unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

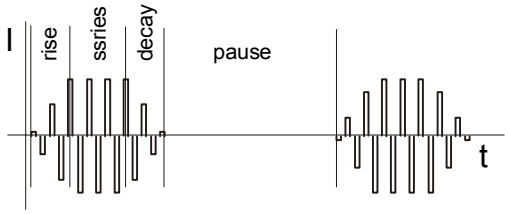
tens: 4: surges of the basic frequency 50 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)

0: 1 / 1	**5:** 6 / 3
1: 1 / 3	**6:** 6 / 6
2: 3 / 1	**7:** 6 / 10
3: 3 / 3	**8:** 10 / 10
4: 3 / 6	**9:** 10 / 20

tens: surges
5: of the basic frequency 25 Hz
6: of the basic frequency 50 Hz
7: of the basic frequency 71 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 18: TENS pulses 100 μs, asymmetric (+/-)

maximum amplitude 140 mA; for the frequency 1000 Hz the maximum is only 100 mA

Note (maximum amplitudes of currents are written at each group):
the courses of pulses of **group 48** are the same, but the basic pulse length is different – 70 μs
the courses of pulses of **group 51** are the same, but the basic pulse length is different – 150 μs
the courses of pulses of **group 54** are the same, but the basic pulse length is different – 200 μs
the courses of pulses of **group 57** are the same, but the basic pulse length is different – 300 μs

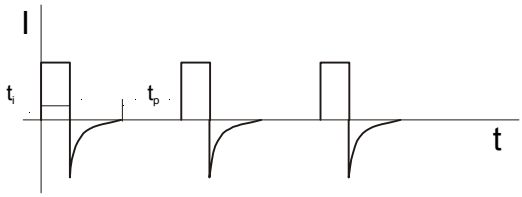
tens: 1: random frequency oscillating around the mean value ± 30 %

mean value of frequency (Hz)
(time between pulses - t_p)

unities:

0: 1 (1 s)	**5:** 100 (9,5 msec)
1: 2 (500 msec)	**6:** 143 (6,5 msec)
2: 5 (200 msec)	**7:** 200 (4,5 msec)
3: 10 (100 msec)	**8:** 250 (3,5 msec)
4: 50 (19,5 msec)	**9:** 1000 (0,5 msec)

tens: 2: constant frequency

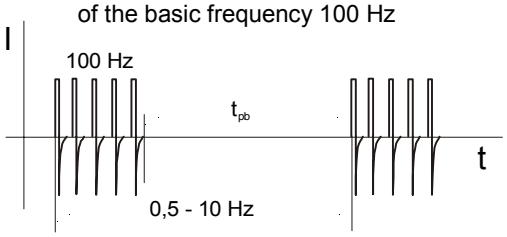


frequency (Hz) (time between pulses - t_p)

unities:

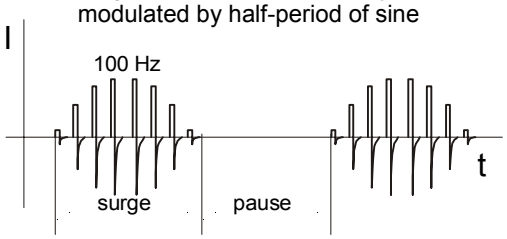
0: 1 (1 s)	**5:** 100 (9,5 msec)
1: 2 (500 msec)	**6:** 143 (6,5 msec)
2: 5 (200 msec)	**7:** 200 (4,5 msec)
3: 10 (100 msec)	**8:** 250 (3,5 msec)
4: 50 (19,5 msec)	**9:** 1000 (0,5 msec)

tens: 3: group of 5 pulses (burst) of the basic frequency 100 Hz



unities
frequency of bursts (pause between bursts - t_{pb})
0: 0,5 Hz (1960 msec)
1: 1 Hz (960 msec)
2: 5 Hz (160 msec)
3: 10 Hz (60 msec)

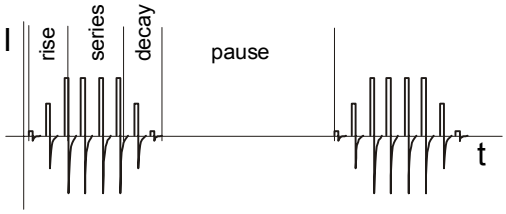
tens: 4: surges of the basic frequency 100 Hz modulated by half-period of sine



unities: interval of surge / pause (sec)

0: 1 / 1	**5:** 6 / 3
1: 1 / 3	**6:** 6 / 6
2: 3 / 1	**7:** 6 / 10
3: 3 / 3	**8:** 10 / 10
4: 3 / 6	**9:** 10 / 20

tens: surges
5: of the basic frequency 50 Hz
6: of the basic frequency 100 Hz
7: of the basic frequency 143 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 19: Programmable sequences (cocktails)

tens: 0 - 2 **unities:** 0 - 9

30 cocktails – program sequences can be programmed and saved.

One cocktail can contain up to 10 courses of currents with the maximum total duration of 60 minutes.

A change of course can come every half a minute. The equipment notifies the attendant about the change by a sound signal (if the sound signalling is on) for possible correction of intensity.

In the equipment settings (Su11) you can specify if at the change of course the equipment shall decrease the intensity to zero and wait for the new setting or preserve the intensity setting from the previous stage and continue the therapy without interruption.
Automatic continuation in the therapy and preservation of intensity from the previous stage is defaultly set from the manufacturing.

At creation of cocktails remember that it is not suitable to combine currents which are differently felt by the patient. At automatic change of current there could occur an intensive feeling of pain.
Therefore it is suitable to enter only combinations of the following currents in one program sequence:

diadynamic currents (groups 01, 31, 32 and 33)
pulses of one polarity with the DC component and the same length (e.g. group 02)
biphasic pulses with the zero DC component (e.g. groups 03 and 04)
mid-frequency bipolar currents (groups 07, 28, 29)
two-pole interference (groups 09, 27)
TENSes of the same base length

The program sequences cannot contain the courses which use both channels at a time – interference (groups 08, 20 – 26).

The following sequences are predefined from the manufacturing:

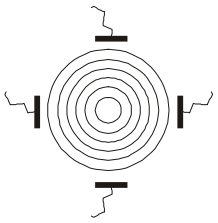
sequence	number of current	polarity	time [min:sec]
1900	0112	+	0:30
	0161	+	4:00
	0161	-	4:00
Total time:			8:30
1901	0112	+	1:00
	0161	+	4:00
	0161	-	4:00
Total time:			9:00
1902	0111	+	1:00
	0161	+	4:00
	0161	-	4:00
Total time:			9:00
1903	0112	+	1:00
	0162	+	5:00
Total time:			6:00
1904	0111	+	0:30
	0161	+	4:00
	0161	-	4:00
Total time:			8:30

Group 20: Isoplanar vector field

basic carrier frequency 4 kHz
channel A - constant frequency, channel B – modulated within the range 3,8 kHz – 4 kHz
amplitudes of channels rytmically continuously oscillate in the antiphase with the selected period - tens
maximum current 100 mA

interval and way of retuning of frequency: **tens:**	**unities:**	modulation (Hz)	
1: frequency jumping 1 s/1 s	**1:** 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz
2: frequency jumping 3 s/3 s	**2:** 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz
3: frequency jumping 6 s/6 s	**3:** 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz
4: continuous change 3 s/3 s	**4:** 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz
5: continuous change 5 s/5 s	**5:** 90-150	i.e. AMF = 90 Hz; Spectrum = 60 Hz
6: continuous change 6 s/6 s	**6:** 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz
7: random 1 s/1 s	**7:** 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz
8: random 3 s/3 s	**8:** 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz
9: random 6 s/6 s	**9:** 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz

Isoplanar field:



Group 21: Isoplanar vector field

basic carrier frequency 10 kHz
channel A - constant frequency, channel B – modulated within the range 9,8 kHz – 10 kHz
channel amplitudes rytmically continuously oscillate in the antiphase with the selected period - tens
maximum current 100 mA

interval and way of retuning of frequency: **tens:**	**unities:**	modulation (Hz)	
1: frequency jumping 1 s/1 s	**1:** 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz
2: frequency jumping 3 s/3 s	**2:** 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz
3: frequency jumping 6 s/6 s	**3:** 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz
4: continuous change 3 s/3 s	**4:** 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz
5: continuous change 5 s/5 s	**5:** 70-140	i.e. AMF = 70 Hz; Spectrum = 70 Hz
6: continuous change 6 s/6 s	**6:** 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz
7: random 1 s/1 s	**7:** 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz
8: random 3 s/3 s	**8:** 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz
9: random 6 s/6 s	**9:** 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz

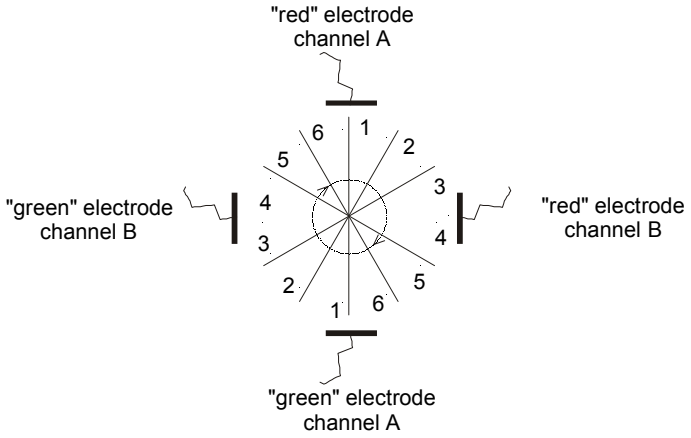
Note:
These currents create so-called isoplanar vector field in the tissue. It is essentially the classic interference, the centre of the activity of activity of which is being moved in the tissue by changes of channel amplitude. Thus the field is “spread” to a larger area in the tissue.

Group 22: Dipole vector field, manually rotating

basic carrier frequency 4 kHz
both channels have the same frequency, modulated by the frequency AMF and Spectrum with changes every 1 sec
the dipole rotation is achieved by modulation of amplitude and phase of channels
maximum current 100 mA

modulation (Hz): **tens:**		position of the field dipole: (relative to the axis of electrodes of channel A) **unities:**
1: 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz	**1:** 0° (180°)
2: 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz	**2:** 30° (210°)
3: 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz	**3:** 60° (240°)
4: 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz	**4:** 90° (270°)
5: 90-150	i.e. AMF = 90 Hz; Spectrum = 60 Hz	**5:** 120° (300°)
6: 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz	**6:** 150° (330°)
7: 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz	
8: 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz	
9: 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz	

Dipole vector field - manually rotated:
(numbers of “units” indicate rotation of the field)



Group 23: Dipole vector field, manually rotating

basic carrier frequency 10 kHz
both channels have the same frequency, modulated by the frequency AMF and Spectrum with changes every 1 sec
the dipole rotation is achieved by modulation of amplitude and phase of channels
maximum current 100 mA

modulation (Hz): **tens:**		position of the field dipole: (relative to the axis of electrodes of channel A) **unities:**
1: 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz	**1:** 0° (180°)
2: 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz	**2:** 30° (210°)
3: 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz	**3:** 60° (240°)
4: 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz	**4:** 90° (270°)
5: 90-140	i.e. AMF = 90 Hz; Spectrum = 60 Hz	**5:** 120° (300°)
6: 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz	**6:** 150° (330°)
7: 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz	
8: 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz	
9: 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz	

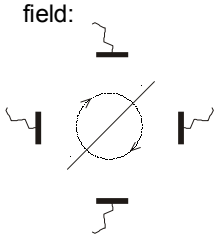
Note:
These groups create so-called dipole vector isoplanar field in the tissue. This field has only one direction of acting – thus the required area of therapy can be exactly targeted.

Group 24: Dipole vector field, automatically rotating

basic carrier frequency 4 kHz
both channels have the same frequency, modulated by the frequency AMF and Spectrum with the period 1 sec
automatic rotation of the dipole is achieved by modulation of amplitude and phase of channels
maximum current 100 mA

modulation (Hz): **tens:**		speed of the vector's rotation **unities:**
1: 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz	**1:** 3 revolutions per 1 second
2: 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz	**2:** 2 revolutions per 1 second
3: 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz	**3:** 1 revolution per 1 second
4: 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz	**4:** 1 revolution per 2 seconds
5: 90-150	i.e. AMF = 90 Hz; Spectrum = 60 Hz	**5:** 1 revolution per 3 seconds
6: 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz	**6:** 1 revolution per 5 seconds
7: 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz	**7:** 1 revolution per 7 seconds
8: 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz	**8:** 1 revolution per 10 seconds
9: 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz	**9:** 1 revolution per 15 seconds

Dipole vector field:



Group 25: Dipole vector field, automatically rotating

basic carrier frequency 10 kHz
both channels have the same frequency, modulated by the frequency AMF and Spectrum with the period 1 sec
automatic rotation of the dipole is achieved by modulation of amplitude and phase of channels
maximum current 100 mA

modulation (Hz): **tens:**		speed of the vector's rotation **unities:**
1: 1-10	i.e. AMF = 1 Hz; Spectrum = 9 Hz	**1:** 3 revolutions per 1 second
2: 1-100	i.e. AMF = 1 Hz; Spectrum = 99 Hz	**2:** 2 revolutions per 1 second
3: 30-60	i.e. AMF = 30 Hz; Spectrum = 30 Hz	**3:** 1 revolution per 1 second
4: 60-100	i.e. AMF = 60 Hz; Spectrum = 40 Hz	**4:** 1 revolution per 2 seconds
5: 90-140	i.e. AMF = 90 Hz; Spectrum = 60 Hz	**5:** 1 revolution per 3 seconds
6: 100-150	i.e. AMF = 100 Hz; Spectrum = 50 Hz	**6:** 1 revolution per 5 seconds
7: 100-200	i.e. AMF = 100 Hz; Spectrum = 100 Hz	**7:** 1 revolution per 7 seconds
8: 120-200	i.e. AMF = 120 Hz; Spectrum = 80 Hz	**8:** 1 revolution per 10 seconds
9: 150-200	i.e. AMF = 150 Hz; Spectrum = 50 Hz	**9:** 1 revolution per 15 seconds

Group 26: 4-pole interference 10 kHz

basic carrier frequency 10 kHz
channel A - constant frequency, channel B – modulated within the range 9,8 kHz – 10 kHz
maximum current 100 mA
modulation and retuning – see **group 08**

Group 27: Amplitude-modulated current (2-pole interference)

basic carrier frequency 10 kHz
maximum current 140 mA
modulation – see **group 09**

Group 28: Bipolar surges

carrier frequency 4 kHz modulated by rectangular pulse
maximum current 140 mA
frequency of pulses, pulse/pause ratio, definition of surges – see **group 07**

Group 29: Bipolar surges

carrier frequency 10 kHz modulated by rectangular pulse
maximum current 140 mA
frequency of pulses, pulse/pause ratio, definition of surges – see **group 07**

Group 31: Diadynamic currents interrupted by the frequency 8 kHz (+/-)

duty factor 95 %
otherwise the courses of currents (DF, MF...) and base are the same as for **group 01**; for picture see group 01

Group 32: Diadynamic currents with the basic frequency 60 Hz (+/-)

tens:	current name and description, other specifications	maximum
1:	DF – sinusoidal pulses 8,3 msec without pause, frequency 120 Hz (two-way-rectified mains frequency 60 Hz)	70 mA
2:	MF – sinusoidal pulses 8,3 msec with pause 8,3 msec, frequency 60 Hz (one-way-rectified mains frequency 60 Hz)	100 mA
3:	CP - 1 sec pulses of the type DF, 1 sec pulses of the type MF	80 mA
4:	LP – 10 sec combination of MF and DF pulses, 6 sec MF pulses	80 mA
5:	RS – 1 sec sinusoidal pulses MF, 1 sec pause	100 mA
6:	CP-ISO - 1 sec pulses of the type DF, 1 sec pulses of the type MF with the amplitude 15 % lower than DF pulses	80 mA

unities:	specifications
1:	without base (base is the permanent DC component which the pulses are added to)
2:	base 0,5 % of the set current frequency
3:	base 1 % of the set current frequency
4:	base 2 % of the set current frequency
5:	base 5 % of the set current frequency
6:	base 10 % of the set current frequency
7:	base 20 % of the set current frequency

For picture see group 01.

Group 33: Diadynamic currents with the basic frequency 60 Hz interrupted by the frequency 8 kHz (+/-)

duty factor 95 %
otherwise the courses of currents (DF, MF...) and base are the same as for **group 32**
For picture see group 31.

Group 40: TENS pulses 20 μs, symmetric

basic pulse length 20 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 10**

Group 41: TENS pulses 20 μs, alternating

basic pulse length 20 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 11**

Group 42: TENS pulses 20 μs, asymmetric

basic pulse length 20 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 12**

Group 43: TENS pulses 30 μs, symmetric

basic pulse length 30 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 10**

Group 44: TENS pulses 30 μs, alternating

basic pulse length 30 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 11**

Group 45: TENS pulses 30 μs, asymmetric

basic pulse length 30 μs
maximum current 140 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 12**

Group 46: TENS pulses 70 μs, symmetric (+/-)

basic pulse length 70 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 100 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 16**

Group 47: TENS pulses 70 μs, alternating

basic pulse length 70 μs
maximum amplitude 140 mA, for the frequency 500 Hz the maximum is only 100 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 17**

Group 48: TENS pulses 70 μs, asymmetric (+/-)

basic pulse length 70 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 100 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 18**

Group 49: TENS pulses 150 μs, symmetric (+/-)

basic pulse length 150 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 90 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 16**

Group 50: TENS pulses 150 μs, alternating

basic pulse length 150 μs
maximum amplitude 140 mA, for the frequency 500 Hz the maximum is only 90 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 17**

Group 51: TENS pulses 150 μs, asymmetric (+/-)

basic pulse length 150 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 90 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 18**

Group 52: TENS pulses 200 μs, symmetric (+/-)

basic pulse length 200 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 80 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 16**

Group 53: TENS pulses 200 μs, alternating

basic pulse length 200 μs
maximum amplitude 140 mA, for the frequency 500 Hz the maximum is only 80 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 17**

Group 54: TENS pulses 200 μs, asymmetric (+/-)

basic pulse length 200 μs
maximum amplitude 140 mA, for the frequency 1000 Hz the maximum is only 80 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 18**

Group 55: TENS pulses 300 μs, symmetric (+/-)

basic pulse length 300 μs
maximum amplitude 140 mA, for the frequency 250 Hz the maximum is only 120 mA, for 1000 Hz – max. 60 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 16**

Group 56: TENS pulses 300 μs, alternating

basic pulse length 300 μs
maximum amplitude 140 mA, for the frequency 125 Hz the maximum is only 120 mA, for 500 Hz – max. 60 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 17**

Group 57: TENS pulses 300 μs, asymmetric (+/-)

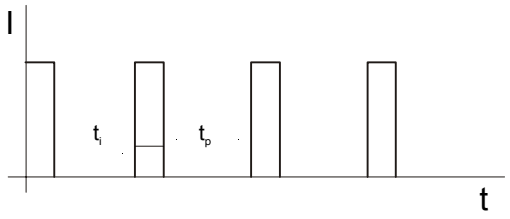
basic pulse length 300 μs
maximum amplitude 140 mA, for the frequency 250 Hz the maximum is only 120 mA
frequency and shape of pulses, frequency of bursts and frequency of surges – see **group 18**
the maximum adjustable frequency 250 Hz

Group 60: Rectangular pulses 2 msec of one polarity (with the DC component) (+/-)

maximum amplitude 140 mA; for the frequency 71 Hz only 130 mA, for 100 Hz 110 mA and for 143 Hz 90 mA

Note (maximum amplitudes of currents are written at each group):
courses of pulses of **group 63** are the same, but the basic pulse shape is different – triangular pulses with slow rise
courses of pulses of **group 66** are the same, but the basic pulse shape is different – exponential pulses
courses of pulses of **group 69** are the same, but the basic pulse shape is different – exponential pulses with slow rise

tens:
1: random frequency oscillating around the mean frequency ± 30 %

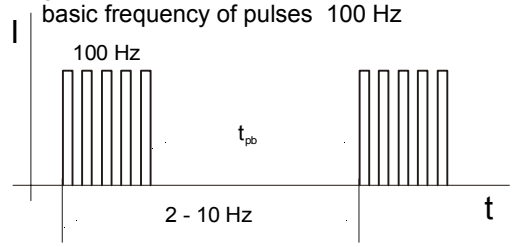


unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (998 msec)
1: 2 Hz (498 msec)
2: 5 Hz (198 msec)
3: 7 Hz (138 msec)
4: 10 Hz (98 msec)
5: 20 Hz (48 msec)
6: 50 Hz (18 msec)
7: 71 Hz (12 msec)
8: 100 Hz (8 msec)
9: 143 Hz (5 msec)

tens:
2: fixed frequency of pulses

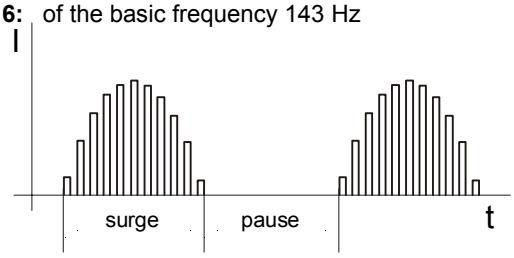
unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (998 msec) **5:** 20 Hz (48 msec)
1: 2 Hz (498 msec) **6:** 50 Hz (18 msec)
2: 5 Hz (198 msec) **7:** 71 Hz (12 msec)
3: 7 Hz (138 msec) **8:** 100 Hz (8 msec)
4: 10 Hz (98 msec) **9:** 143 Hz (5 msec)

tens:
3: group of 5 pulses (burst), basic frequency of pulses 100 Hz



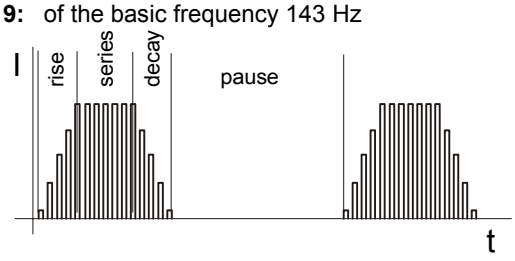
unities: frequency of bursts (time between bursts – t_{pb})
0: 0,5 Hz (1958 msec)
1: 1 Hz (958 msec)
2: 2 Hz (458 msec)
3: 5 Hz (158 msec)
4: 7 Hz (101 msec)
5: 10 Hz (58 msec)

tens: surges modulated by half-period of sine
4: of the basic frequency 50 Hz
5: of the basic frequency 100 Hz
6: of the basic frequency 143 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 3 / 1
3: 3 / 3
4: 3 / 6
5: 6 / 3
6: 6 / 6
7: 6 / 10
8: 10 / 10
9: 10 / 20

tens: surges
7: of the basic frequency 50 Hz
8: of the basic frequency 100 Hz
9: of the basic frequency 143 Hz



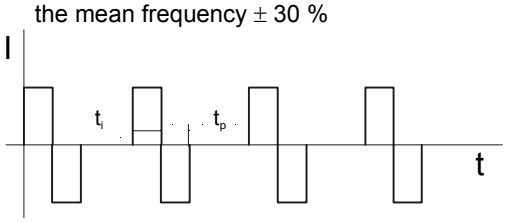
unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 61: Rectangular pulses 2 msec, biphasic symmetric (+/-)

maximum amplitude 140 mA,
for the frequency 50 Hz only 110 mA, for 71 Hz 90 mA, for 100 Hz 75 mA and for 143 Hz 65 mA

Note (maximum amplitudes of currents are written at each group):
courses of pulses of **group 64** are the same, but the basic pulse shape is different – triangular with slow rise pulses
courses of pulses of **group 67** are the same, but the basic pulse shape is different – exponential pulses
courses of pulses of **group 70** are the same, but the basic pulse shape is different – exponential pulses with slow rise

tens:
1: random frequency oscillating around the mean frequency ± 30 %

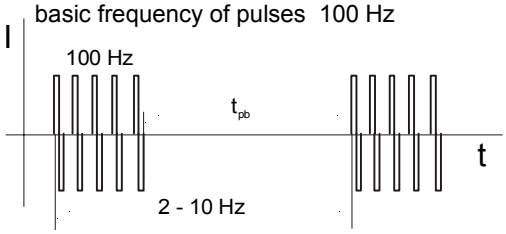


unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (996 msec)
1: 2 Hz (496 msec)
2: 5 Hz (196 msec)
3: 7 Hz (136 msec)
4: 10 Hz (96 msec)
5: 20 Hz (46 msec)
6: 50 Hz (16 msec)
7: 71 Hz (10 msec)
8: 100 Hz (6 msec)
9: 143 Hz (3 msec)

tens:
2: fixed frequency of pulses

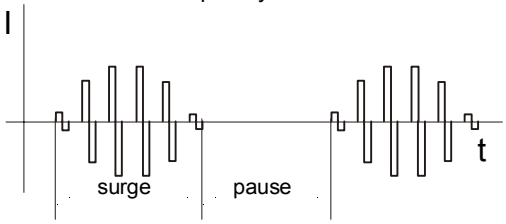
unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (996 msec) **5:** 20 Hz (46 msec)
1: 2 Hz (496 msec) **6:** 50 Hz (16 msec)
2: 5 Hz (196 msec) **7:** 71 Hz (10 msec)
3: 7 Hz (136 msec) **8:** 100 Hz (6 msec)
4: 10 Hz (96 msec) **9:** 143 Hz (3 msec)

tens:
3: group of 5 pulses (burst), basic frequency of pulses 100 Hz



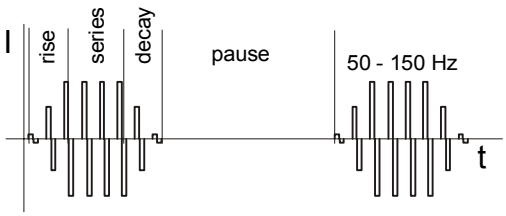
unities: frequency of bursts (time between bursts – t_{pb})
0: 0,5 Hz (1958 msec)
1: 1 Hz (958 msec)
2: 2 Hz (458 msec)
3: 5 Hz (158 msec)
4: 7 Hz (101 msec)
5: 10 Hz (58 msec)

tens: surges modulated by half-period of sine
4: of the basic frequency 50 Hz
5: of the basic frequency 100 Hz
6: of the basic frequency 143 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 3 / 1
3: 3 / 3
4: 3 / 6
5: 6 / 3
6: 6 / 6
7: 6 / 10
8: 10 / 10
9: 10 / 10

tens: surges
7: of the basic frequency 50 Hz
8: of the basic frequency 100 Hz
9: of the basic frequency 143 Hz



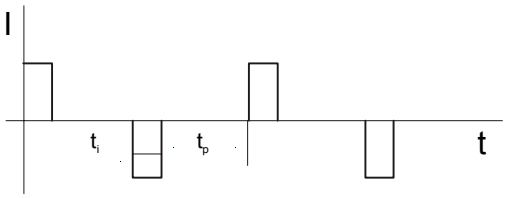
unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 62: Rectangular pulses 2 msec, biphasic alternating

maximum amplitude 140 mA, for the frequency 36 Hz only 130 mA, for 50 Hz 110 mA and for 71 Hz 90 mA

Note (maximum amplitudes of currents are written at each group):
courses of pulses of **group 65** are the same, but the basic pulse shape is different – triangular pulses with slow rise
courses of pulses of **group 68** are the same, but the basic pulse shape is different – exponential pulses
courses of pulses of **group 71** are the same, but the basic pulse shape is different – exponential pulses with slow rise

tens:
1: random frequency oscillating around the mean frequency ± 30 %

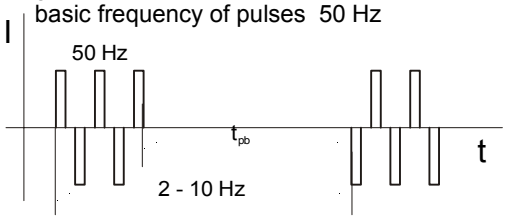


unities: frequency of pulses (time between pulses – t_p)
0: 0,5 Hz (998 msec)
1: 1 Hz (498 msec)
2: 2,5 Hz (198 msec)
3: 3,6 Hz (138 msec)
4: 5 Hz (98 msec)
5: 10 Hz (48 msec)
6: 25 Hz (18 msec)
7: 36 Hz (12 msec)
8: 50 Hz (8 msec)
9: 71 Hz (5 msec)

tens:
2: fixed frequency of pulses

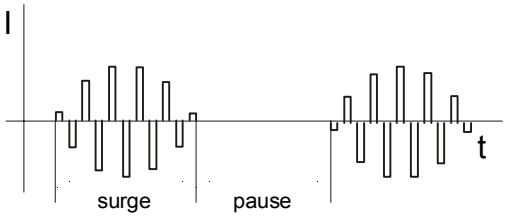
unities: frequency of pulses (time between pulses – t_p)
0: 0,5 Hz (996 msec) **5:** 10 Hz (46 msec)
1: 1 Hz (496 msec) **6:** 25 Hz (16 msec)
2: 2,5 Hz (196 msec) **7:** 36 Hz (10 msec)
3: 3,6 Hz (136 msec) **8:** 50 Hz (6 msec)
4: 5 Hz (96 msec) **9:** 71 Hz (3 msec)

tens:
3: group of 5 pulses (burst), basic frequency of pulses 50 Hz



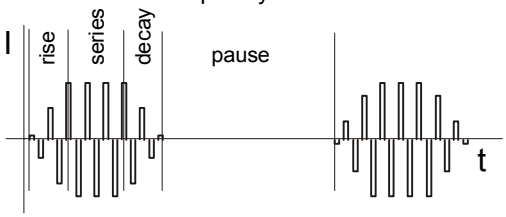
unities: frequency of bursts (time between bursts – t_{pb})
0: 0,5 Hz (1958 msec)
1: 1 Hz (958 msec)
2: 2 Hz (458 msec)
3: 5 Hz (158 msec)
4: 7 Hz (101 msec)
5: 10 Hz (58 msec)

tens: surges modulated by half-period of sine
4: of the basic frequency 25 Hz
5: of the basic frequency 50 Hz
6: of the basic frequency 71 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 3 / 1
3: 3 / 3
4: 3 / 6
5: 6 / 3
6: 6 / 6
7: 6 / 10
8: 10 / 10
9: 10 / 20

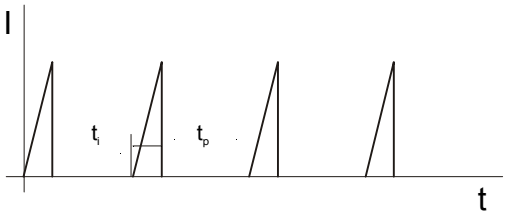
tens: surges
7: of the basic frequency 25 Hz
8: of the basic frequency 50 Hz
9: of the basic frequency 71 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

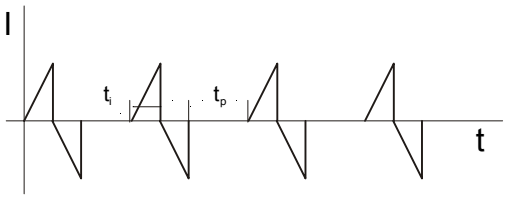
Group 63: Triangular pulses 2 msec of one polarity (with the DC component) (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 60**
basic shape of pulses:



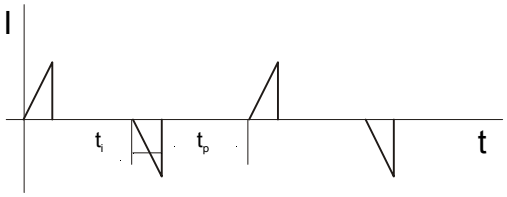
Group 64: Triangular pulses 2 msec, biphasic symmetric (+/-)

maximum amplitude 140 mA, for the frequency 143 Hz max. amplitude only 130 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 61**
basic shape of pulses:



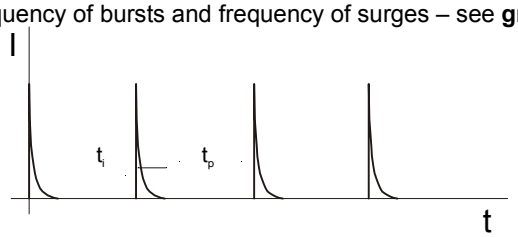
Group 65: Triangular pulses 2 msec, biphasic alternating (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 62**
basic shape of pulses:



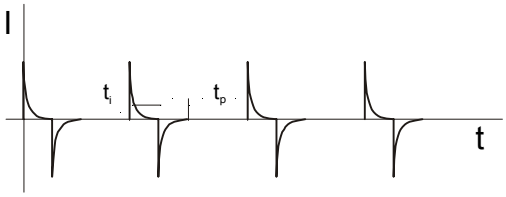
Group 66: Exponential pulses 2 msec of one polarity (with the DC component), (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 60**
basic shape of pulses:



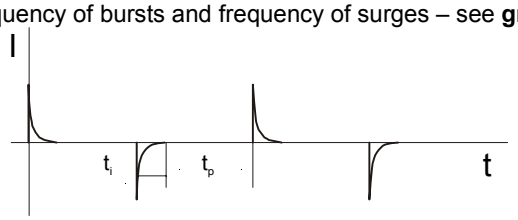
Group 67: Exponential pulses 2 msec, biphasic symmetric (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 61**
basic shape of pulses:



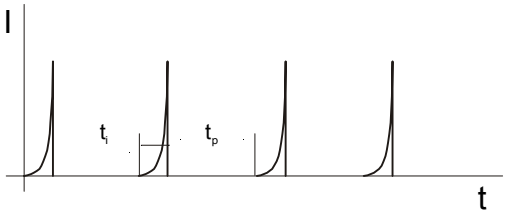
Group 68: Exponential pulses 2 msec, biphasic alternating (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 62**
basic shape of pulses:



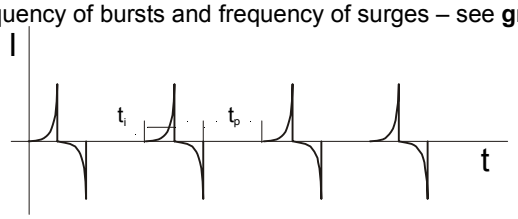
Group 69: Exponential pulses 2 msec of one polarity with slow rise (with the DC component), (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 60**
basic shape of pulses:



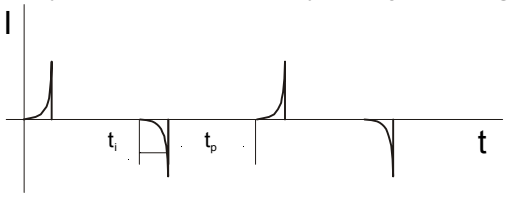
Group 70: Exponential pulses 2 msec, biphasic symmetric with slow rise (+/-)

maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 61**
basic shape of pulses:



Group 71: Exponential pulses 2 msec, biphasic alternating with slow rise (+/-)

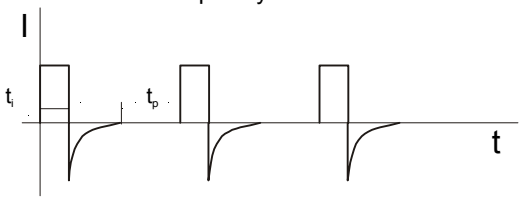
maximum amplitude 140 mA
frequency of pulses, frequency of bursts and frequency of surges – see **group 62**
basic shape of pulses:



Group 72: Combined pulses 2 msec, biphasic asymmetric (rectangle-exponential pulse) (+/-)

maximum amplitude 140 mA, for the frequency 50 Hz maximum amplitude only 110 mA
zero DC component

tens:
1: random frequency oscillating around the mean frequency ± 30 %

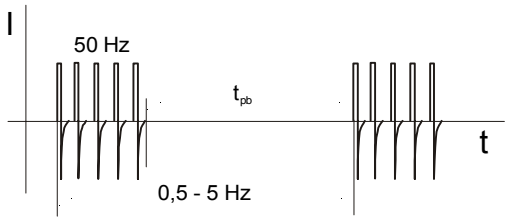


unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (986 msec)
1: 2 Hz (486 msec)
2: 5 Hz (186 msec)
3: 7 Hz (129 msec)
4: 10 Hz (86 msec)
5: 20 Hz (36 msec)
6: 50 Hz (6 msec)

tens:
2: fixed frequency of pulses

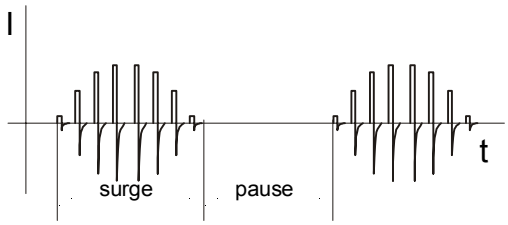
unities: frequency of pulses (time between pulses – t_p)
0: 1 Hz (986 msec) **5:** 20 Hz (36 msec)
1: 2 Hz (486 msec) **6:** 50 Hz (6 msec)
2: 5 Hz (186 msec)
3: 7 Hz (129 msec))
4: 10 Hz (86 msec)

tens:
3: group of 5 pulses (burst), basic frequency of pulses 50 Hz



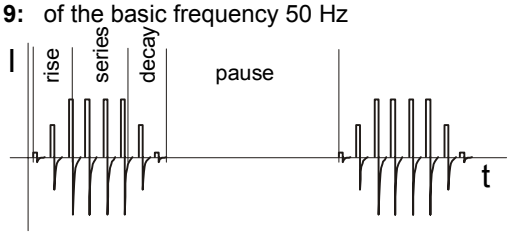
unities: frequency of bursts (time between bursts – t_{pb})
0: 0,5 Hz (1906 msec)
1: 1 Hz (906 msec)
2: 2 Hz (406 msec)
3: 5 Hz (106 msec)
4: 7 Hz (49 msec)

tens: surges modulated by half-period of sine
4: of the basic frequency 10 Hz
5: of the basic frequency 20 Hz
6: of the basic frequency 50 Hz



unities: time of surge / time between pulses (sec)
0: 1 / 1
1: 1 / 3
2: 3 / 1
3: 3 / 3
4: 3 / 6
5: 6 / 3
6: 6 / 6
7: 6 / 10
8: 10 / 10
9: 10 / 20

tens: surges
7: of the basic frequency 10 Hz
8: of the basic frequency 20 Hz
9: of the basic frequency 50 Hz



unities: rise / time of series / decay / pause (sec)
0: 1 / 1 / 1 / 2
1: 2 / 1 / 1 / 3
2: 2 / 2 / 1 / 5
3: 2 / 3 / 1 / 7
4: 3 / 5 / 1 / 10
5: 3 / 10 / 1 / 10
6: 5 / 10 / 1 / 20
7: 10 / 10 / 1 / 10
8: 10 / 10 / 1 / 20
9: 20 / 10 / 1 / 30

Group 98: Test of electrodes, test of patient cables

tens:	**unities:**	
1:	**1:**	test of electrodes
		Good – electrodes are O.K.
		Poor – electrodes still can be used
		bAd – electrodes are bad
	2:	test of cables
		Good – cables are O.K.
		bAd – cables are bad

During the test, low secure voltage is supplied to the electrodes or cables. Nevertheless, if you accidentally touch both electrodes at a time you can feel unpleasant itching.

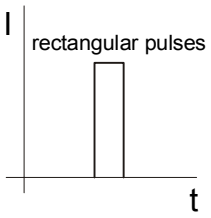
During the test we therefore recommend to lay one of the electrodes on the table and press the other one gently against. Then start the test by the intensity buttons ▲ / ▼ of the appurtenant channel. To stop the test press the **STOP** button of the appurtenant channel. Do not touch both electrodes at a time!

During the cable test first short-circuit both ends of the cables – banana plugs (hold the non-metal parts) and then start the test by the intensity buttons ▲ / ▼ of the appurtenant channel. To stop the test press the **STOP** button of the appurtenant channel.

In case of another result than "Good" we recommend to contact the service department of the company stated at the end of this document.

Group 99: Programmable rectangular and triangular pulses

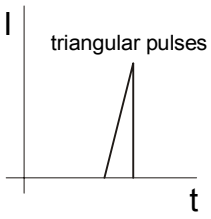
tens: 0 – 5 **unities:** 0 – 9



Up to 60 currents can be programmed and saved.

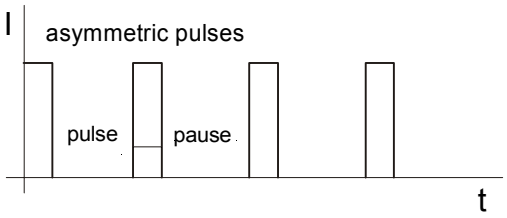
Programming is divided into 3 parts (menus).

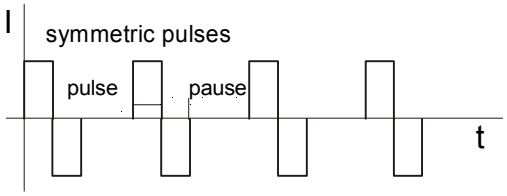
1.: **"PULS"** menu:
- pulse length: from 1 msec to 63,75 msec, step of setting: 0,25 msec
- pulse shape: **„rEct“** rectangular; **„triA“** triangular
- course of pulses: **„ASYM“** pulses of one polarity with the DC component; **„SYM“** symmetric pulses; **„ALtE“** alternating pulses

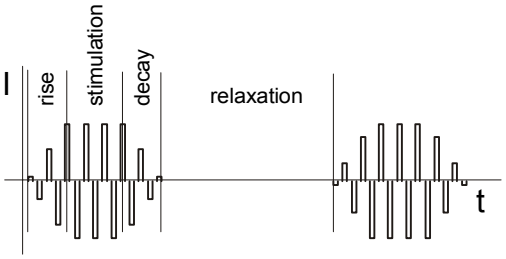


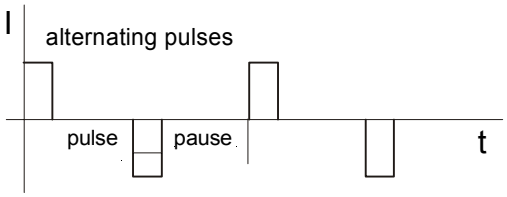
2.: **"PAUS"** menu:
- pause length: from 1 msec to 5 sec, step of setting: variable

3.: **"EnvE"** menu:
- without envelope: **„Cont“**
- with envel. of surges: **„SUrG“**
  - surge rise: from 1 sec to 36 sec, step of setting: 1 sec
  - stimulation: from 1 sec to 36 sec, step of setting: 1 sec
  - surge decay: from 1 sec to 36 sec, step of setting: 1 sec
  - relaxation: from 1 sec to 36 sec, step of setting: 1 sec









This product is manufactured in accordance with the EU Medical Devices Directive by:

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E-mail: sales@btlnet.com
http://www.btlnet.com

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Name of the patient:: .....

Date of birth: ..... Insurance company.....

Examining physician.....

Anamnesis:

Clinical diagnosis:

Examined muscle: .....

Values determined:

No. of curve	Date	Rheobasis [mA]	Chronaxie [msec]	Accommodation coefficient	Stimulation pulses (program – intensity [mA]) / notes

Note: